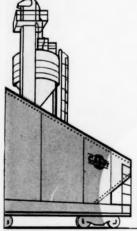
INDIA QUBBER WORLD

OCTOBER, 1947



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NA-11 fills the demand for a vulcanization accelerator for neoprene compounds which combines safety in processing with strong activation at curing temperatures. It is effective in all types of neoprene.

With NA-11, neoprene compounds can be vulcanized to a high state of cure without sacrificing efficiency in the utilization of curing equipment. This high state of cure results in optimum properties in the vulcanizate, such as: low compression and permanent set, high resilience, maintenance of original characteristics upon aging, and resistance to stiffening at low temperatures.

NA-11 is one of the best accelerators for neoprene latex compositions. It is particularly suited for binders for bonded hair and fibrous products; for industrial gloves, metal coatings, and foam latex products made from neoprene or blends of neoprene with other latices.

Readily dispersed ... economical ... safe

More complete information

on NA-11 is contained in Report 47-5. If you have not already received your copy, one will be sent on request. Write to: E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division, Wilmington 98, Del.

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RISTON

KRISTON designates a group of thermosetting resins with many unusual properties. Products made from KRISTON may have excellent optical properties, unusually good electrical properties plus resistance to most normally destructive factors. As the clock at the left shows, products made from KRISTON can be most decorative in this and other forms such as jewelry, buckles, buttons, frames, desk sets, coasters, ash trays and many others. KRISTON is a relatively new product, and we invite suggestions and inquiries as to possible applications.

Hycar

HYCAR is the name applied to a group of American rubbers that have found wide usage in both consumer and industrial products. Typical are the household items shown at right which, like other products made from HYCAR, resist water, grease and oil, heat, aging, abrasion and many other destructive factors. HYCAR OR-15 is exceptionally oil resistant, and is an important material in the oil fields as well as in general industry. HYCAR and GEON may be blended for certain uses to impart to finished products the most favorable properties of each. (Products courtesy of Wooster Rubber Co., Wooster, Ohio.)





Good-rite

GOOD-RITE is the brand name of a constantly growing group of widely diversified chemicals. GOOD-RITE Erie, for example, is one of several outstanding chemicals for the rubber industry. GOOD-RITE p.e.p.s. is a new fungicide that promises great things for the future in agriculture. And there is a large group of intermediate organic chemicals which are finding new uses daily. The GOOD-RITE name is growing, and is certain to become an important one in many different industries.

We make no finished products from any of these raw materials. But we will be glad to work with you on any special problems or applications. For more information, or for an informative glossary of technical terms used in the Plastics and Rubber Industries, please write Department HA-10, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company THE B. F. GOODRICH COMPANY

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THE Wire in Your Tire" is a 24-page, richly illustrated book, brief in text. Not an engineering treatise, not a catalog, it has been prepared particularly for non-technical men in and associated with the rubber industry. However, many engineers tell us that they too have found it interesting and helpful. Its purpose is to give a broader, clearer understanding of the vital functions of steel wire in tire beads...a better

knowledge of the exacting requirements and varied applications that are a part of the interesting tire-building operations.

You are welcome to a free copy of this book. Just drop us a card or note today. And, after you have gone over "The Wire in Your Tire", if you would like some additional copies for certain friends or associates, you'll find us glad to cooperate . . . as usual. National-Standard Company, Niles, Mich.



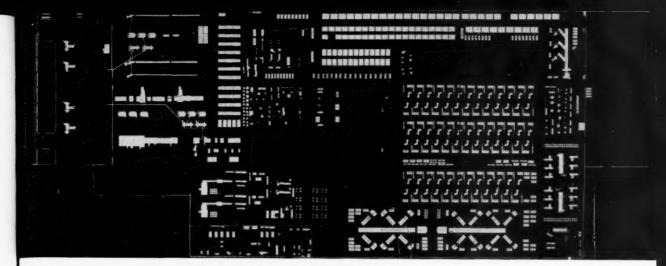
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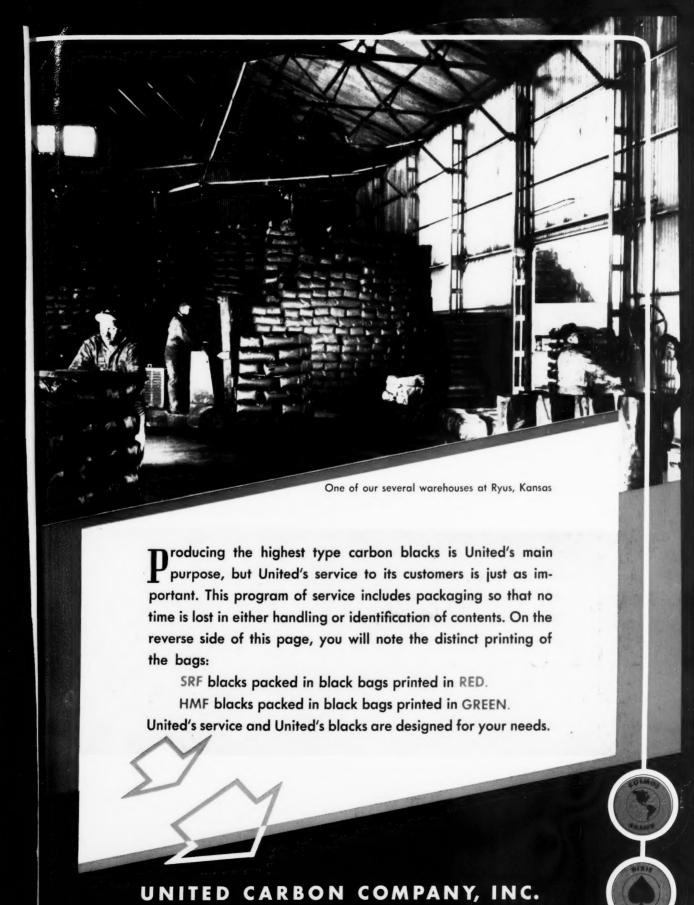
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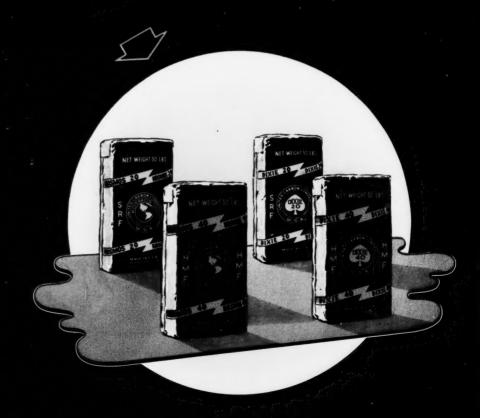
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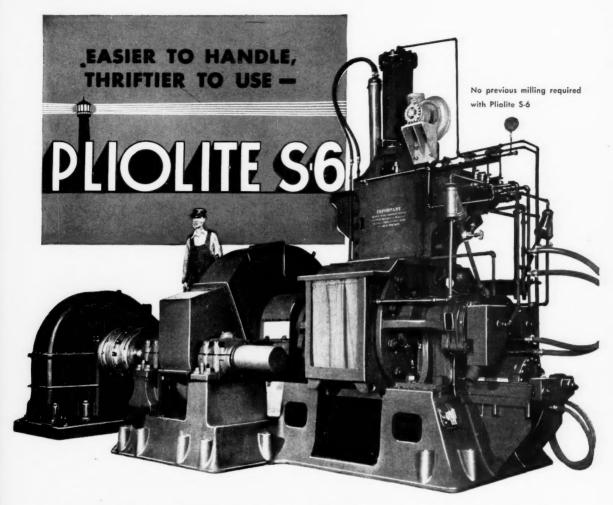
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By eliminating preliminary heavy-duty milling, this light-gravity, non-discoloring resin saves you considerable time and money. In addition, **PLIOLITE 5-6** gives you these other valuable advantages:

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GOODFYEAR

THE GREATEST NAME IN RUBBER

Announcement

- We beg to announce that MOORE & MUNGER have changed the name of their Clay Department to P. W. MARTIN GORDON CLAYS, INC., which incorporation took effect as of August 1st, 1947.
- With this incorporation, there has been no change in the personnel or any change in their sales policy or products for the sale of BUCA, CATALPO, PIGMENT 33, WHITETEX, AND SYN-THETIC 100 (Polyisobutylene produced by Standard Oil Co. of New Jersey)
- Our Mr. E. W. Schwartz will be technical sales representative as formerly along with Mr. W. H. Shields.
- We hope to have your continued use of our products.

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With airbag drawn up in ram, tire is placed in position.

Downstroke shapes tire and bags it simultaneously.





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General Offices: AKRON 8, OHIO

Creative Engineering



• To the casual observer, everything looked fine for synthetic rubber when tires began to set mileage records.

But elsewhere there was trouble. The successful use of synthetics in producing the much-needed hard and semi-hard rubber stocks was baffling the industry's technicians. Tree rubber, with its high natural plasticity, was easy to mill with added carbon black and other materials. Until recently, however, the peculiar stiffness of synthetic rubber made it very difficult to "load" these stocks sufficiently.

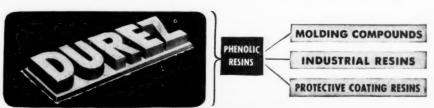
So Durez engineers joined the search, bringing in twenty-six years of specialized experience with the phenolic plastics. Out of this collaboration came Durez thermosetting phenolic resins with the very useful ability to soften synthetic rubber in milling.

The Durez resins, being completely compatible with synthetic rubber, also reinforce it. Resultant stocks possess great tensile strength, a high degree of hardness, excellent elongation, improved abrasion resistance, and flexibility at low temperatures.

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GLYCERIZED lends that glossy, satiny finish so desirable ... GLYCERIZED is a versatile lubricant of unparalleled pro-

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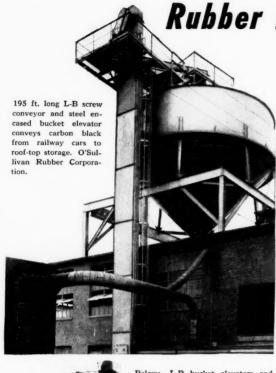
• About the meanest handling job in the rubber industry is conveying carbon black, but makers and users alike are reporting highly satisfactory service from Link-Belt conveyors and elevators on this difficult assignment. Pictured here are typical installations of Link-Belt screw conveyors and bucket elevators, which have overcome major difficulties of handling this material in a clean and waste-free manner.

Link-Belt elevating and conveying machinery includes types especially suited to handling coal and ashes, as well as overhead conveyors for moving rubber sheets, rubber products and molds through the various processes. Link-Belt belt conveyors and Bulk-Flo elevator-conveyors have special advantages for certain types of materials. Consult Link-Belt and be sure to receive equipment of the right type, and helpful counsel from materials handling specialists, to make the most effective application.

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Bulk-Flo (left) and Peck Carrier (above) are two of several L-B conveyors for handling coal at boiler houses.



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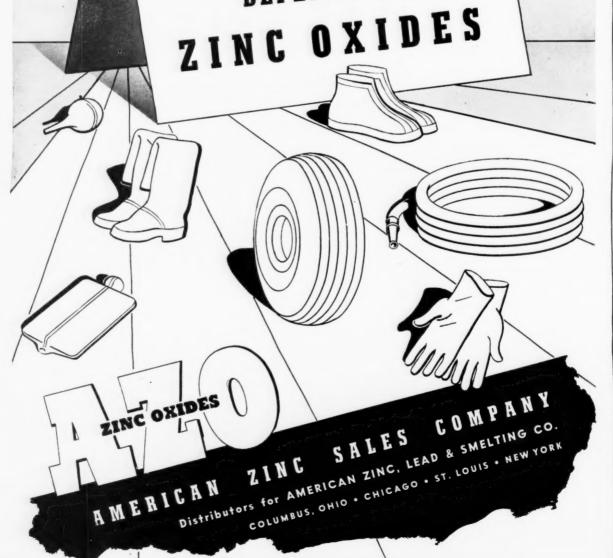
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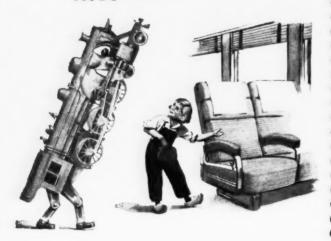
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Dutch Boy: "They do; for instance, if you make tires all seven advantages apply. But most of them are important with other products, too."

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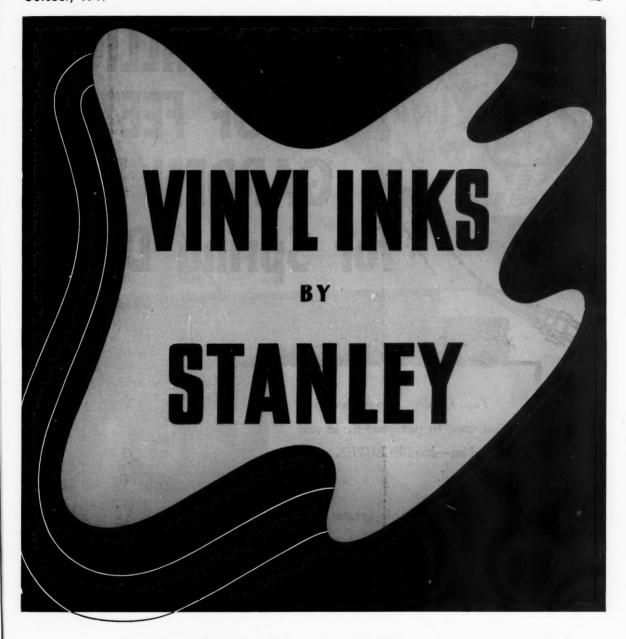
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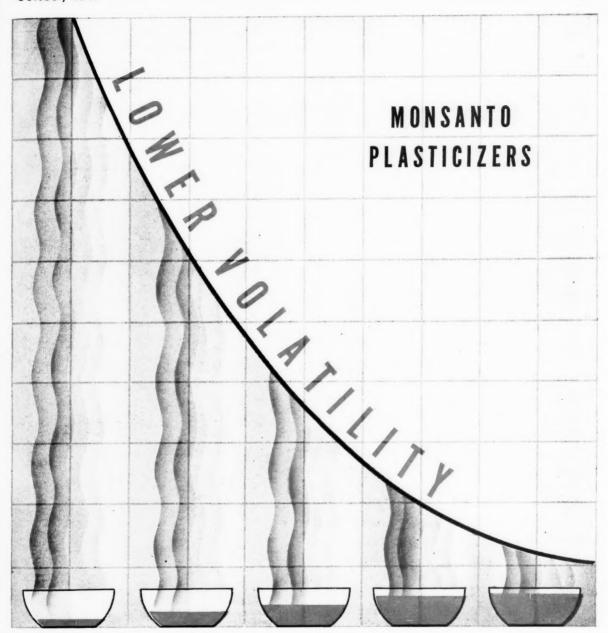
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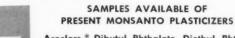
Lower ranges of volatility are being established by a series of new Monsanto plasticizers, now well advanced in the process of development. Their greater permanence will add increased usefulness to many applications.

In addition, extensive field tests and laboratory findings indicate that these new Monsanto plasticizers will also provide high standards

of compatibility, flexibility, fire retardance, heat and light stability, elasticity, abrasion resistance.

For the present, most of these Monsanto plasticizers are not commercially available, since their production depends largely on chemicals now in short supply. However, Monsanto research and field tests are being continued with emphasis on those new plasticizers that can be produced from raw materials most likely to be available soonest, in greatest quantities.

If you have any present or prospective plasticizer problems, Monsanto may be able to help you with application suggestions. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri... District Sales Offices: New York, Philadelphia, Chicago, Boston, Detroit, Cleveland, Cincinnati, Charlotte, Birmingham, Houston, Los Angeles, San Francisco, Seattle. In Canada: Monsanto (Canada) Limited, Montreal.



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*Reg. U. S. Pat. Off.



Technical Bulletin No. 37

on the Compounding of GR-S with Substantial Loadings of ZINC OXIDE

Blends of Natural Rubber and GR-S-10 with 100 Parts of Zinc Oxide

(Refer to Technical Bulletin No. 34)

(See also July, 1947, Rubber Journals)

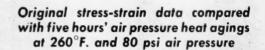
COMPOUNDS No. A and B NATURAL RUBBER GR-S-10

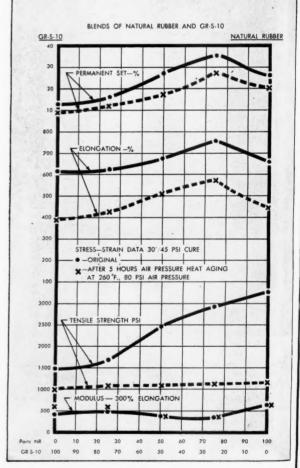
Smoked S	She	et			100.0	GR-S-1	0.					100.0
Sulfur					3.0	Sulfur						3.0
MBT .					1.0	MBT .						2.0
"Agerite	Po	wd	er"		1.0	DPG .						0.1
Stearic A	cid				3.0	Couma	ron	e-in	den	e R	esin	3.0
ZINC OX	IDI	E			100.0	E.L.C.	Mag	nes	ia		٠	5.0
						ZINC	OXII	DE				100.0

AIR PRESSURE heat aging reduces the tensile strength of all of the compounds to approximately 1,000 psi. The modulus values of the aged compounds are essentially equal to the original values. The elongation is reduced by substantially constant amounts for all of the blends. On account of the higher elongation of the 75 NR: 25 GR-S-10 blend and its retention of elongation after aging, it would appear that this blend offers possibilities in applications where severe aging conditions are involved.

The excellent heat aging characteristics of 100% GR-S-10 and 75 GR-S-10: 25 NR blends, as indicated by the comparatively low depreciation after aging in tensile strength,

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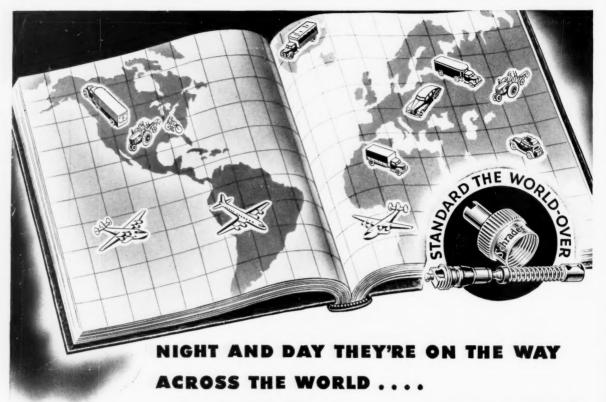
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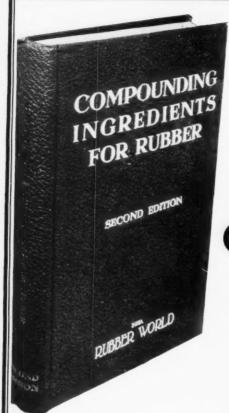
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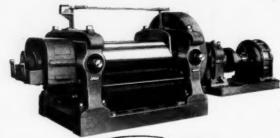
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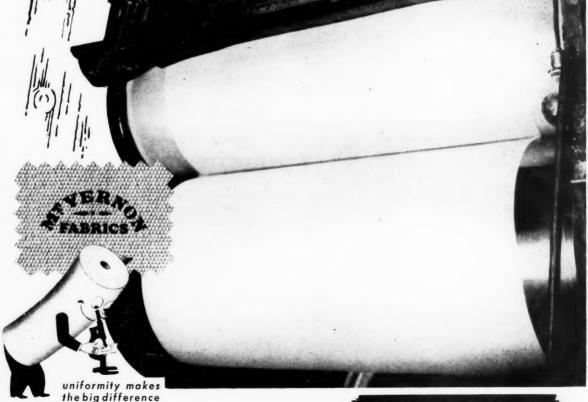
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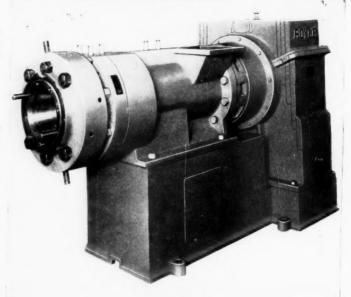
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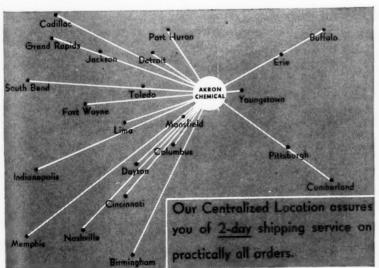
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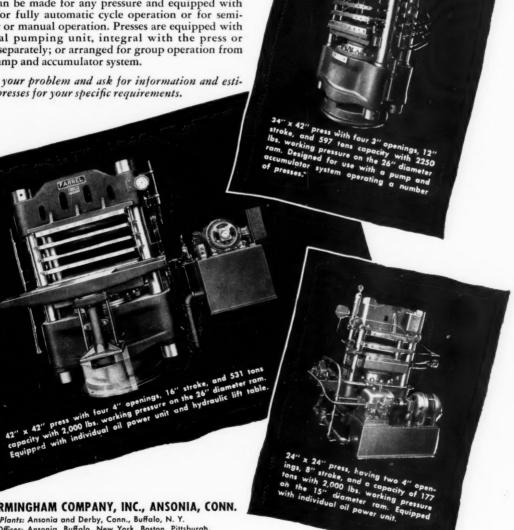
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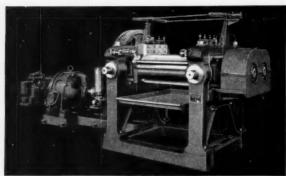
But there was not enough suitable quartz available to build all the filters needed. Bell Telephone Laboratories scientists met the emergency with cultivated crystals. Years of research enabled them to write the prescription at once—a crystal which is grown in a laboratory, and which replaces quartz in these channel filters.

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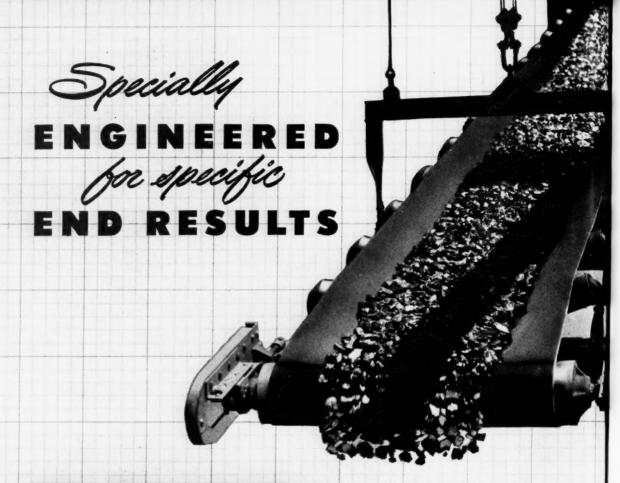


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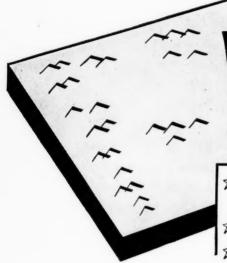
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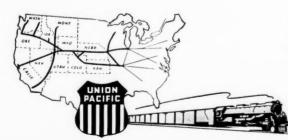
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October, 1947

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Number 1

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ARTICLES

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INDIA RUBBER WORLD

NATURAL & SYNTHETIC

Volume 117

New York, October, 1947

Number 1

Standardization of Testing and Inspection in Government Synthetic Rubber Plants

HIS article is one of the several presented before the A. S. T. M. Symposium on Rubber Testing, held in connection with the fiftieth annual meeting of that Society in Atlantic City, N. J., June 16-20, 1947. The symposium, sponsored by Committee D-11 on Rubber and Rubber-Like Materials, attempted to cover the work that has been done with regard to the physical and chemical methods of test, both on synthetic and natural rubbers, making available to industry the accomplishments of government and industry during the period of the war, when secrecy had to be maintained. All of the papers will be published in a separate booklet by the Society some time within the next few months. EDITOR.

REVIOUS papers of this symposium have discussed the developments in test methods that have made possible the present uniformity of synthetic rubber produced in government plants. The paper by W. R. Hucks4 described the various groups which cooperated with Rubber Reserve in achieving this task. In the present paper we will attempt to give a detailed description of how standardization was achieved both within a plant and among the plants. Perhaps the best way to do this will be to follow the development of the test methods and the standardization of control that led to the uniformity of production with respect to some single property, for example, the ratio of butadiene to styrene bound in the GR-S polymer. In Table 1 the average bound styrene content of production from each of 16 GR-S plants is given for the month of February each year since 1944, together with the corresponding standard deviations since 1945 (the first year the plants analyzed production for this property), which show the variability of production in each plant. It will be observed that the uniformity of production with respect to this property has improved from year to year. The

Ludwig Meuser, Robert D. Stiehler,² and R. W. Hackett³

variability of production within each plant has decreased in most instances, and the variability from plant to plant has become decidedly smaller. Let us see how this was achieved.

At the beginning of the program in 1942 and 1943 no test was available suitable for the control or inspection of bound styrene in GR-S production. The composition of the product in this regard depended upon the ratio of the monomers charged to the reactors and the percentage conversion of these monomers to polymer.

TABLE 1	STYPENE	Rouve	The	CDS	Darvacen

Febr	uary, 1944	Febru	ary, 1945	Febru	tary, 1946	Febru	tary, 1947
Plant	Mean*	Mean %	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1 2 3 4	23.4 23.8 27.2 23.3	23.5 22.3 23.2 23.3	.27 .29 .25 .24	23.10 23.80 23.60 23.20	.32	23.50 23.40 23.65 23.60	.14
5 6 7 8	22.9 24.0 21.7 24.4	23.7 23.3 23.9 22.9	.44 .29 .41 .31	23.60 23.20 23.55 23.55	.14	23,75 23,65 23,55 23,65	
9 10 11 12	23.9 22.8 23.6 24.0	23.0 23.2 23.1 22.9	.34 .37 .29 .22	23.80 23.50 23.55 23.35	.16	23.65 23.55 23.50	.18 .26 .07
13 14 15 16	24.4 24.6 24.1 23.6	22.8 23.1 23.3 22.7	.21 .16 .31 .28	23.20 23.80 23.15 23.10	.43	23.95 23.25 23.20 23.35	.20 .50 .11 .22
Aver.†	23.8	23.1	.49	23.50	.39	23,50	.28

*Based on analyses made by Bell Telephone Laboratories.
†Average weighted on basis of number of tests (corresponding approximately to quantity of production) at each plant.

United States Rubber Co., New York, N. Y.
"National Bureau of Standards, Washington, D. C.
"Office of Rubber Reserve, Washington, D. C.
"Function of Rubber Reserve, Past, Present and Projected," India Rubber World, July, 1947, p. 509.

The methods for determining the charging ratio and for controlling the polymerization reaction were not sufficiently reliable to assure uniform operations. Consequently the bound styrene in the product varied from less than 20 to almost 30%, as analyzed at the Bell Telephone Laboratories by an interferometer method. This led to hit-and-miss methods of adjusting the charging ratio from plant to plant near the end of 1943 and the beginning of 1944. Obviously a suitable control method and a standardization program in the plants were needed.

Standardization of Bound Styrene in GR-S Production

The National Bureau of Standards was assigned the task of developing a method suitable for inspection testing in the plants. During this development work in the early months of 1944, blended samples from each week's production at each plant were sent to the Bell Telephone Laboratories and analyzed there by the interferometer method. These analyses enabled the plants to decrease the variation in composition of the blended samples from production, from 10% in December, 1943, to less than 3% by August, 1944. By this time the refractiveindex method for determining bound styrene had been developed, and the weekly blended samples were analyzed at the National Bureau of Standards as well as at the Bell Telephone Laboratories until the end of September, 1944, when the analyses at the latter laboratory were discontinued.

During the last months of 1944 the refractive-index method was introduced into the plants. The National Bureau of Standards supplied each plant with a glass test specimen of known refractive index for calibrating the refractometers to the same standard. Also, each plant received a sample from each of five polymers of different bound styrene contents, which served as a cross-check on the development of their technique with this method. In most cases the plant laboratories were soon able to obtain results in agreement with the values found by the National Bureau of Standards. Where troubles were encountered, a visit of laboratory personnel to another laboratory generally solved the difficul-

By January 1, 1945, the plants had begun to use this method for inspection of their production. Weekly blended samples, however, continued to be analyzed by the National Bureau of Standards until the end of August, 1945, by which time most plants had developed a good precision of testing and had their production under satisfactory control. It was soon found, however, that constant vigilance is required after production is tunder control in order to keep it so. This point is illustrated in Table 1 by plants 1 and 14 which did not control production so well in February, 1947, as they did in February, 1945.

Importance of Reference Lot of Rubber in Standardization

The introduction of the refractive-index method for bound styrene content of the final product served as a tool for the inspection of the process control methods. In order to have a continuous surveillance of the testing technique employed for this inspection method, each plant laboratory determined each day the bound styrene content of a reference sample from a blended lot of GR-S. In order to standardize the other chemical methods of analysis in the GR-S plants, a daily test for each property was made on this same blended sample. Standardization of the physical test methods was accomplished

through daily tests on larger unblended reference lots, These reference lots of the various rubbers served perhaps as the most important single tool in standardizing the testing procedures in the plants. Although the Office of Rubber Director established the reference lot ORD 45 for standardization of research compounding in March, 1943, the first reference lot for production control was used in the GR-S plants in May, 1944. To date there have been seven such lots of GR-S, three lots of GR-I, and two lots of GR-M. (Incidentally, GR-M must be stored below 40° F, for this purpose, since the properties of GR-M change with time of storage at higher temperatures.) As each new reference lot was established, it was standardized against the previous lot. Thus the testing of these lots has served as a continuous check on the accuracy and precision of testing for each property in each plant. Prior to the reference lots an attempt was made to standardize the testing procedures in the various plants by means of monthly crosstests on a blended sample. After nine such monthly crosstests it became obvious that a daily control test was necessary if satisfactory standardization were to be achieved. The little additional labor and cost of such a program has been repaid manyfold in the improvement in uniformity of product quality that has resulted.

Standardization of Physical Test Methods

In the case of physical test methods additional standardization was required beyond that afforded by a daily test of a reference lot. For example, it was necessary to establish uniform lots of compounding ingredients in order to eliminate variability from this source. This also entailed the replenishment of such lots with new lots of identical characteristics. The suppliers of the compounding ingredients were called upon to meet tolerances not previously attained in their industries. New lots of these materials were standardized at the Government Evaluation Laboratory and the National Bureau of Standards by means of rigid specification procedures established by the Subcommittee on Test Methods of the Committee on Specifications for Synthetic Rubbers. The use of these ingredients became mandatory in the Specifications for Government Synthetic Rubbers early in the program.

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Besides the establishment of uniform lots of compounding ingredients, it was necessary to standardize the testing equipment and to correct defects in equipment design which gave variable results. As mentioned in a previous paper5 of this symposium, modifications in the design of the Mooney viscometer and an educational program on its use and maintenance were necessary. The former was achieved with the cooperation of the manufacturer, and the latter by a visit of R. H. Taylor, National Bureau of Standards, to each plant laboratory. In the case of equipment for stress-strain testing, gears for the rubber mill had to be replaced wherever the roll speeds did not conform to the specification. Also, standardization was required of the calibration procedure for press-curing temperatures, of the dies and markers for preparing test specimens, and of the calibrating and operating procedures for the stressstrain testers.

Quality Reports and Sampling Procedures

Other factors which led to variability in testing have been discussed in previous papers of this symposium.

*Development and Standardization of Tests for Evaluating the Processibility of Rubber." Rolla H. Taylor, J. H. Fielding, M. Mooney, Rubber Age (N. Y.) Aug., 1947, p. 567.

(Plant and Location)

INSPECTION REPORT ON GR-S PRODUCTION February , 1945

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MEAN																									T							T
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46	1/		3	3	1			6				3	1	2	2	1				3		6									32	1.5
47	3	2	7	9	4	3	9	25	8	1	1	10	11	2	6	1	4	5	3	6	8	10	1				1	1			141	6.
48	13	7	9	10	23	7	19	32	9	3	9	6	8	15	16	21	11	19	18	7	20	10	7			4	2	6			311	15.0
49	16	19	23	20	21	14	23	16	13	14	16	12	5	16	20		16	12	10	10	18	10	23			-	1	4			375	18.
50	28	17	19	29	18	18	22	10	14	12	21	14	8	14	14	20	20	18	23	14			36	15		14	11	18			485	23
51	23	26	26	12	13	26	14	2	15		12	7	11	6	9	8	14	13	13	12	9	13	16	29			15				389	18.
52	7	14	13	4	11	15	5		12	9	7		3	6	2		6	2	3	12	3	1	9	21				23			214	10.
53	1	11	20	1	1	7	2		5		2						2	1	1	5	1		1	11				17			89	4.
54		1	4		1	4			4					1			1			2				7				4			29	1.1
55			3																									1			4	0.
56																									-			-			7	1
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56.5	11	Ť						2				2	1	1			1	1				1			-	-	-		-		9	4
58.5	1		1	1	2			5	3	2	1	-	3	4	1	5	2	2	1	3	2	3	2	5	-	1	3	1		-	54	24.
JO.J	4	3	4	4		3	1		3	2	3	3	2	1	4	2	2	1	4	5	3	2	8	3		4	1	2			82	37.
	3	6	6	3		3	2		3	2	2	3	~	-	1	a	3	2	3		1	~	0	9		-	5	5		-	54	24.
60.5		-	1	_		4	5		1	2	~	-					_	-	_		,	1	1		-	-		2			17	7.
60.5 62.5				-						-						-						-				1					1 //	1.
60.5 62.5 64.5	2							-	-			-		-	-		-	-					-		-	-		-			-	-
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Fig. 1. Form Used to Indicate Frequency Distribution of Test Data for Each Property

As these factors were discovered, they were incorporated into the Specifications for Government Synthetic Rubbers. In the developing of these specification methods, the policy was adopted to select the best practical method, to have a single procedure with no alternates, and to include all the specific instructions known to be necessary. This policy required compromise of the views of different groups or individuals in many instances. Its soundness was established many times, however, for whenever erratic or abnormal results were obtained, they could generally be traced to departure from specification procedure.

The standardization of the testing procedure would have been to no avail if the samples tested were not representative of the lot tested. Accordingly, standard sampling procedures were established. The determination of volatile matter, ash, and Mooney viscosity were performed on random samples taken periodically from production. The other chemical and physical tests were performed on a daily blended composite from a production line as a compromise to avoid excessive testing. Many preferred to use a blended sample from several production lines to facilitate plant operation. Such a procedure, however, was shown to be unsound statistically and was, therefore, abandoned.

Coordination of Testing and Quality Control

As mentioned in a previous paper of this symposium, the major policy for standardization of quality was established by the Committee on Specifications for Synthetic Rubbers and was administered by Rubber Re-

serve. To assist in the administration there was assigned to each plant a field representative, whose prime responsibility was to check on the testing techniques and quality of production. These representatives performed invaluable services in the coordination work of Rubber Reserve directed toward standardization of testing procedures, sampling techniques, and quality of production. They also assisted in the standardization of methods for controlling the process of manufacture. In addition to the field representatives, members of the Washington Office of Rubber Reserve visited the plants frequently, and instructions were issued in the form of official memoranda, known as PDRS memoranda (Production Division, Rubber Section).

The prime responsibility for carrying out the policy of the Committee on Specifications for Synthetic Rubbers, however, was delegated to the product testing and quality control group of Rubber Reserve. This group made a statistical analysis of plant data and formulated the detailed procedures which were issued as PDRS memoranda and which were necessary to accomplish the goal of the established policy.

Quality Reports

Since the middle of 1943 the plants have submitted to Rubber Reserve each day the test results obtained on the production lots and also on the reference lot after such lots were established. At the end of each month the plants submitted a summary of the data on their production during the month. In the early days of the program only the high, low, and mean values for each

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property were included in the summary. In the latter part of 1944 the distribution of the data for each property was submitted each month on a form illustrated in Figure 1. This form was designed so that daily trends and variations in production for the month reported

could be noted quickly and easily.

The test data on quality of production submitted by the plants were compiled at the end of the month into a comparative report by Rubber Reserve. The early reports gave only the high, low, and mean values submitted by the plants in the monthly summaries. This information showed plant-to-plant variation, but was insufficient to determine how well the bulk of production was controlled. Beginning with the report for September, 1944, these reports contained distribution curves of production for each property to show within-plant variations. At the same time an educational program was undertaken to acquaint the plants with the meaning and usefulness of the statistical term "standard deviation" for denoting variability.

Acceptance Specification and Performance Ratings

This program culminated in the establishment of an acceptance specification on January 1, 1945, and in the reporting of production variation with respect to each property in the form of standard deviation. The acceptance specification had a range between limits approximately two-thirds the range in the Specifications for Government Synthetic Rubbers. These limits were based on the assumption that more than 95.5% of production normally distributed about the mean of the limits would meet the acceptance specification if 99.7% or more met the official specification.

The monthly comparative reports were revised at the same time in order to incorporate all pertinent information. Bar charts were used to summarize the thousands of test results and show at a glance the quality level and uniformity of production at each plant. Figure 2 illus-

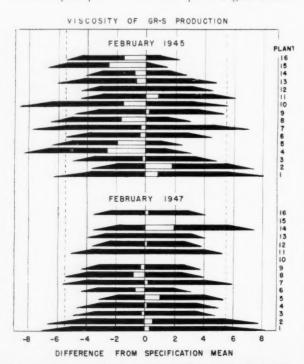


Fig. 2. Bar Chart Used to Summarize Monthly Data for Each Property on Production from Each Plant, Dotted Lines Indicate Statistical Limits of the Specification

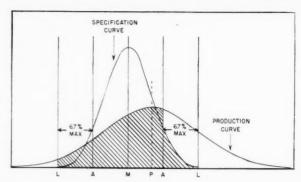


Fig. 3. Schematic Diagram Illustrating Calculation of Performance or "A" Rating: Lines Marked "L" Are at the Specification Limits; Line "M" Is Midway between Limits "L"; Lines Marked "A" Are Midway between Lines "M" and "L". No Credit Is Given for Production outside Lines "L"; a Maximum of 8.7% Credit Is Given for Production between Lines "A" and "L" on Each Side of Midpoint "M", and Full Credit Is Given for Production between Lines "A"

trates such charts for the viscosity of GR-S production during February, 1945, and February, 1947, respectively. The length of the lower edge of the bars in this figure corresponds to six times the standard deviation which statistically includes 99.7% of production. Similarly, the length of the upper edge corresponds to approximately four times the standard deviation which statistically includes 95.5% of production. Consequently the pointed ends of the bars represent about 2.1% of the total production. The length of the white segment in the bar indicates the deviation of the mean viscosity of production from that of the specification. The dotted lines indicate the statistical limits of the specification. Thus the position of the bar with respect to the specification limits indicates at a glance both the uniformity and quality level of production. It is obvious from these charts that many plants in the early part of 1945 were producing rubber with fairly uniform properties, but the average quality level differed from plant to plant and did not correspond to the mean of the specification limits. In this connection many were of the opinion that it was sufficient if production was just within specification limits. An educational program was therefore necessary to have the plants strive for the mean of the specification limits for those properties that had both maximum and minimum limits.

To assist in the accomplishment of this end, performance has also been judged by an "A" rating system since the latter half of 1945. This system was predicated on the assumption that the range between the specification limits could be divided into six "specification" standard deviations and that a normal "specification" distribution curve could be constructed with the node at the midpoint "M" of the limits "L" as illustrated in Figure 3. The system attempted to determine the area of the actual distribution of production that was included in the area of the "specification" distribution curve between the limits "L" in Figure 3. This determination required elaborate calculations that were not practical for routine use. Consequently a compromise method was developed whereby the distribution curve of production with mean at "P" was normalized as shown in Figure 3. The area of this curve included between $\pm 1\frac{1}{2}$ "specification" standard deviations from the mean of the specification limits (lines marked "A" in Figure 3) was determined. To this area was added the area included under the production curve between the lines "A" and "L" in Figure 3 up to a maximum on each side of the mean of 6.7% of the total area of the curve. This percentage is

*Temperature of cure 292° F.

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Table 2. Stress-Strain Properties of GR-S Production

		1 29 / T	121			Modul	us at 300 %	Elongation, P.S	S.I.	
	50-Mit	ength, P.S.I. n. Cure*		n. Cure*	25-3	lin, Cure*	50-Min	ı. Cure*	90-Mi	n. Cure*
Month	Aver.	Std. Dev.	Aver.	Std. Dev.	Aver.	Std. Dev.	Aver.	Std. Dev.	Aver.	Std. Dev.
11/44	2940	170	630	36	470	71	965	9.3	1330	108
1/45	20.35	164	625	35	470	68	990	79	1375	79
4/45	3050	176	635	3.2	460	46	990	64	1380	70
7/45	3065	180	625	28	440	39	1000	5.2	1385	63
10/45	3110	198	600	32	435	39	1025	5.2	1420	58
1/46	2000	175	630	28	455	39	1025	46	1420	5.3
4/46	2 200 =	157	640	30	455	51	1020	49	1425	47
7/46	3215	139	645	24	455	32	1010	45	1415	51
10/46	2 3/1/1	159	645	29	445	40	1005	5.4	1475	51
1/47	2.2000	146	645	25	440	40	1010	49	1415	56

the theoretical area of a normal distribution curve that lies beyond 1½ standard deviations on each side of the mean. This combined area, shown darkened in Figure 3 and expressed as a percentage of the total area, was taken as the performance or "A" rating for controlling production with respect to the property concerned. By combining the "A" ratings for each property it was possible to indicate the overall performance of each plant each month by a single number. These ratings were included in the monthly comparative reports. Through the competitive spirit existing among the plants the ratings had a marked influence on improving the uniformity of production and caused the level to approximate the mean of the specification limits.

The end result can be noted in Table 1 for bound styrene and in Figure 2 for viscosity. Again, it should be emphasized that after production is under control, constant vigilance is required, or it will go out of control as seen in the case of plant 14 in Figure 2. Although the achievements with respect to uniformity of production were greater for bound styrene and viscosity, similar data could be presented for the other chemical and physical properties. For example, the average value and standard deviation of the stress-strain properties of GR-S production from 16 plants can be seen in Table 2 for each third month since November, 1944, to January, 1947. It is observed that the standard deviations for the modulus values have decreased by a factor of 2 approximately during this time. The standard deviations for tensile strength and elongation at break have not shown such a marked reduction. A smaller reduction was to be expected, however, since the standard deviations obtained on production lots for these two properties were not much larger than those obtained on the reference lot. Not much promise is held for further significant improvements, however, since the precision of testing and control of production with present methods is about as good as can be expected. The present need is improved test methods. Some of the new developments discussed in previous papers of this symposium may be the answer.

Process Control

Obviously, an inspection of the final product is a necessary tool to show how well the process was controlled and at what points process-control techniques must be improved or more closely calibrated. Inspection of the final product alone, will not produce a more uniform product. Consequently an equally important part of the standardization program in the Government Synthetic Rubber Plants was the standardization of process control methods. The various points and methods of control in the GR-S process have been summarized by G. R. Vila and M. D. Gross of the United States Rubber Co., Synthetic Rubber Division, in an article on "The

Application of Statistical Methods to the Production of Synthetic Rubber." Perhaps the most important of these relate to the control of purities of monomers charged, the degree of conversion, and the viscosity of the polymer at the end of the polymerization reaction. A description of the techniques used for their control is beyond the scope of this paper. The standardization of the testing and inspection procedures used in process control, however, followed the same pattern as the standardization of methods used for testing and inspection of final product. Some of the plants have also employed the control chart for controlling the quality of production. This statistical method offers considerable promise as a tool for further improving the uniformity of synthetic rubber production.

Summary

In conclusion, the government synthetic rubber plants started to produce rubber in 1942 and 1943. The rubber produced at that time was not uniform. The first step taken to obtain a uniform product was a standardization of the testing and inspection methods. This step necessarily included an improvement in testing precision by means of refinement of existing methods, development of new methods, and education with respect to testing techniques. At the same time as the tools for inspection and control of production were being improved, plant data on process control and quality of production were collected, consolidated, and analyzed statistically. The summarized data for each month and conclusions drawn therefrom were distributed industry-wide. Through these combined efforts and the competitive spirit among the plants, the present degree of uniformity of synthetic rubber production was achieved. In most cases precision of testing and control of production have been improved to the extent that the present methods will permit. Further advancements will depend on the introduction of improved test methods and control procedures into the plants.

Argentina Changes Import Rulings

The granting of exchange permits for the importation into Argentina of automobile, truck, and bicycle tires has been suspended, according to a Central Bank circular issued June 18. Exempted, however, are imports of odd-size tires not manufactured in the country and those produced only in small quantities and in short supply locally.

Another report indicates that the granting of exchange permits for the importation into the country of a wide variety of textile manufactures, classified under 582 Argentine tariff items, has been suspended. Among the items affected are: oilcloth automobile tire covers, girdles, corsets, rainwear, ponchos, rubber aprons, garters, suspenders, bathing caps, certain narrow fabrics, and cotton and silk corset webbing (elastic).

The Brabender Plastograph in the Rubber Laboratory

NE of the most important operations in the rubber industry is the preliminary softening of crude rubbers by mastication or other means prior to the mixing operation. Better tools for the laboratory investigation of this operation are of great in-

The Brabender plastograph is an instrument designed primarily for the study of materials less viscous than ordinary rubber. Behre and Gohde3 reported on its use for the evaluation of pigments in rubber, but instead of rubber being used as the vehicle a less viscous hydrocarbon was used. One of these instruments has been modified slightly for handling rubber and has demonstrated interesting possibilities for the study, on a small scale, of the mastication operation.

Apparatus and Procedure

The apparatus, as modified, is illustrated in Figures 1 and 2. It consists of a jacketed mixing chamber with a pair of rotors which rotate in opposite directions, one at 90 r.p.m. and the other at 60 r.p.m. The rotors are driven by a 1 3 h.p. motor through an integral reduction unit and a gear box. The motor shell is mounted on bearings, and by means of a series of levers the reaction of the motor shell to the load required to turn the rotors in the mixing chamber actuates a scale and a recorder. Adjustable weights on one end of the lever arm permit adjustment to zero when operating empty, and a weight pan on the other end permits adjustments to maintain the recorder pen within the chart range when tough or soft materials are being handled. For the GR-S reference rubber X-289 a 1,500-gram weight was required. A reduction or an increase of 500 grams on the pan changes the chart reading by 240 units. The scale and chart units are arbitrary. The lever mechanism has several adjustments to accommodate materials of varying consistencies. For rubber, the least sensitive adjustment is used. Also a dash pot is mounted on the lever arm and may be adjusted to minimize wild fluctuations of the recorder arm.

The modifications which were made consisted of the following:

A new set of rotors was made, designed to simulate the action of rotors used in conventional internal mixers.

A jacketed ram was made for holding the material in the mixing space along with a lever arrangement so that weights could be used to hold the ram down.

A set of substantial hose connections was installed suitable for handling ethylene glycol at temperatures up to 160° C.

Improved glands were installed on the rotor shafts to prevent leakage of material from the mixing chamber.

The temperature control device supplied with the equipment was replaced by a DeKotinsky regulator in series with a latch-in relay.

The capacity of the mixing chamber is between 60 and 70 cubic centimeters. For masticating experiments, batches of 60 grams (natural rubber and GR-S) were used. Smaller batches do not adequately fill the mixing

Presented before the Division of Rubber Chemistry, A.C.S., Cleveland, O., May 28, 1947.
28. F. Goodrich Co., Akron, O., **Rautschuk, 15, 160 (1939).

A. E. Juve² and D. C. Hay²

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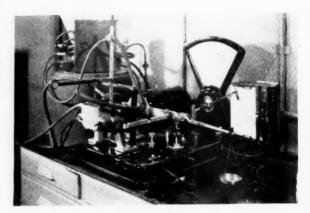


Fig. 1. The Brabender Plastograph

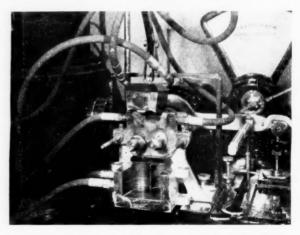


Fig. 2. Close-Up of Brabender Plastograph Mixing Chamber

chamber, and larger batches are not so effectively mas-

The temperature at which a test was run, unless otherwise mentioned, is reported as the temperature of the fluid circulated through the jacket of the mixing chamber. The temperature of the rubber is not necessarily the same, since at low fluid temperatures heat is generated during the mastication, and the rubber temperature is thus higher than the jacket temperature, while at the highest temperatures some heat is lost, and the rubber temperature is slightly below the jacket temperature. Measurements with the fluid at 24° C. showed a rise in temperature of 35° C. after GR-S was masticated 15 minutes. With the fluid temperature at 150° C. the rubber temperature was found to be 146° C.

In running a test the bath temperature is first regulated to the desired level, and at this temperature the weights on the lever arm are adjusted to give a scale reading of zero with the motor running.

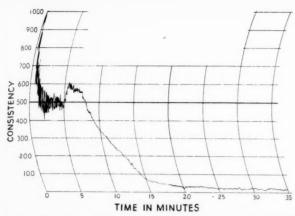


Fig. 3. Consistency-Time Curve—GR-S (X-289) Masticated at 150° C.

The charge of rubber is placed in the mixing chamber, the ram lowered and the recording chart started. Weights may be added to the pan at this point if it is known that such an adjustment is necessary to keep the recorder within its range. The test is then run for the desired time interval which may be as short as 5 minutes or as long as 60 minutes depending on the information desired.

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In Figure 3 is shown a typical curve obtained using 60 grams of GR-S with the jacket maintained at 150° C. During the first five minutes of mastication the chart shows wide fluctuations in the consistency. This condition is due to the alternate sticking and slippage of the rubber past the rotor and the housing. This type of behavior in larger internal mixers has been discussed by Allen and Schoenfeld.4 During this period the rubber is softening (as will be shown below), but the consistency reading shown by the chart is not a true measure of its value. At the point at which these fluctuations cease, the rubber adheres to the rotor, at least sufficiently to damp almost completely these fluctuations. Beyond this point the rubber shows a fairly constant rate of softening for about seven or eight minutes, after which the rate decreases to zero in from five to ten minutes more. The measurements which we have used to characterize the breakdown properties of a rubber in this test are; the time to reach the point at which the pen fluctuations cease (referred to hereafter as the time for adhesion to occur), the rate of change of consistency immediately beyond this point, or the total time required to reach a specific value of consistency.

In Figure 4 are shown the Mooney plasticity values for both natural rubber (#1 RSS) and GR-S (X-289 reference rubber) after various intervals of mastication at 150° C. in the plastograph. This illustrates the point mentioned above that softening occurs during the interval before adhesion to the rotors takes place. This time is indicated on the curves. The rate of softening before and after this point is not appreciably different for either natural rubber or GR-S.

Figure 5 shows the effect of mastication on both natural rubber and GR-S over a range of temperatures. In this curve the log of the time required to reach a consistency of 400 on the scale (with the pan weights used) is plotted against the rubber temperature. Based on these results, the temperature coefficient5 of the softening rate for natural rubber is 1.47 and for GR-S 1.36.

It was observed that modifications of GR-S made to a lower Mooney plasticity gave a higher rate of softening when masticated in the plastograph at 150° C. To study this further, two series of polymers were prepared in the laboratory with varying concentrations of modifiers, but in each case with conversions carried to 72% $\pm 0.5\%$. One modifier was dodecyl mercaptan (DDM), and the other a blend of mixed tertiary mercaptan (MTM) $(60\% C_{12}, 20\% C_{14}, 20\% C_{16})$.

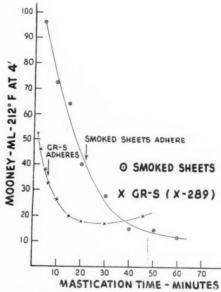


Fig. 4. Mooney Plasticity vs. Mastication Time in the Plastograph at 150° C. for Smoked Sheets and GR-S (X-289)

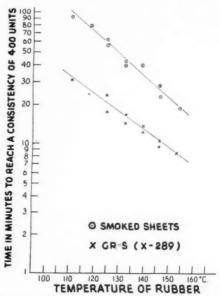


Fig. 5. Time Required to Reach a Specific Consistency vs. Temperature for Smoked Sheets and GR-S (X-289)

The results obtained are illustrated in Figure 6. The two sets of rubbers showed similar rates of softening at 55 ML and above, but quite different results below this point. In the lower plasticity ranges the MTM

Ind. Eng. Chem., 25, 1102 (1933).
 The ratio of the mastication time at one temperature to the mastication time at a temperature 10° C. higher.

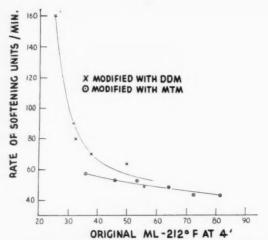


Fig. 6. Original Mooney Plasticity vs. Rate of Softening for Rubber with Different Modifiers

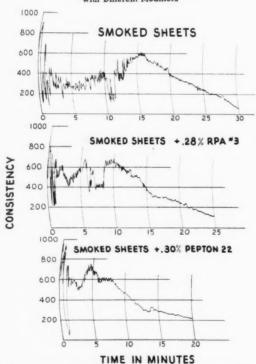


Fig. 7. Consistency-Time Curves—Masticated at 150° C.

modified rubbers soften at a lower rate than the DDM modified rubbers. This difference was confirmed on factory-scale processing tests. In order to process the MTM modified rubbers satisfactorily it was necessary to prepare them at a lower original Mooney plasticity so that with the lower rate of softening during mastication they would arrive at approximately the same consistency as the DDM modified rubbers in the same processing time.

One of the uses to which this instrument can be put is in the study of chemical plasticizers or peptizers. As an illustration, natural rubber, GR-S, and GR-I were masticated at 150° C. with and without the commercial peptizing agents RPA #3 (xylyl mercaptan active agent) and Pepton 22 (0,0' dibenzamidodiphenyldisulfide). The effects produced are shown in Figures 7, 8, and 9 and in Table 1. Both materials are seen to be effective peptizers for all three rubbers.

	TABLE 1	Time Required to Reac a Consistency of 400 In Minutes
Smoked Sheets		
+0.28% RPA =3		
+0.39% Pepton 22		11
GR-S (X-289)		10
+1.64% RPA = 3		4 3/4
+1.50 c Pepton 22		. 5
GR1I		
+1.0% RPA =3		
+1.0% Pepton 22		434

The reproducibility of the test is quite satisfactory. The GR-S standard reference rubber X-289 was run at 150° C. a total of 20 times over a period of six months with the following results:

Time for Rate of SofteningTime Required to Reach Adhesion Units/min, a Consistency of 400 in min. in Min.

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Average Standard Dev	5.6 iation .63	59.3 5.1	1	0.2
	(Contin	ued on pag	e 74)	
900	GR-S	GR-S	GR 1.5% F	-S + PEPTON 22
CONSISTENCY 500 400	***	// ₁	14.	
1515	/1	4	*	
N 400	. /	1	1	
300	. /	11		1
200	1	1 1	1	1-1
100		1	1	1-11

Consistency-Time Curves-Masticated at 150° C.

TIME IN MINUTES

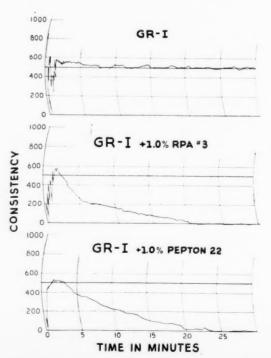


Fig. 9. Consistency-Time Curves—Masticated at 150° C.

Aging and Preservation of Vulcanized Rubber-I'

A Study of Factors Affecting Aging Deterioration of Vulcanized Rubber, Methods for Evaluating and Means of Preservation

THE extensive literature of rubber chemistry is conspicuous for its lack of pertinent information relative to the preservation of vulcanized rubber. The bulk of information available deals with methods of testing and of artificial aging. Suitable tests adequate for prediction of long-term aging effects under natural conditions of storage or service are lacking; consequently authors writing on rubber chemistry are frequently at variance in their recommendations relative to conditions and methods of preservation.

Crude rubber is stored regularly and successfully, but this operation has been avoided with finished, vulcanized articles because of the comparatively rapid deterioration which such goods usually undergo. Most of the investigators in this field agree that vulcanized rubber cures further on aging, and that storage in a damp atmosphere is the best protection against oxidation, but the use of lower temperatures to reduce the rate of after-vulcanization affects adversely the amount of humidity or inert gas which can be maintained in the atmosphere surrounding the articles. The simultaneous

changes which accompany aging in rubber are so numerous and complex, and so little understood, that it appears impossible adequately to cope with them at this time.

Oxidation

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The harmful action of oxygen on rubber, undoubtedly the chief cause of the aging of rubber in air, has been studied and discussed by many investigators (1, 2).3 Eighty years ago Spiller (3) showed that exposure to the atmosphere, during six years, of rubber coated on fabrics produced a shellac-like resin containing 27.5% of oxygen. Subsequently the well-known chemists, Hofmann (4) and Miller (5), found that gutta percha completely submerged in water, or better, sea water, remained unchanged, but that alternate exposure to moisture and dryness, especially in sunlight, quickly rendered it brittle, friable, and resinous. Oxygen was absorbed with increase in weight, and the material became soluble in alcohol and in dilute alkalies. Miller (5) observed the somewhat less rapid occurrence of analogous changes in rubber. Instead of becoming brittle, it turned glutinous, lost elasticity, increased in weight, and became partially soluble in dilute alkalies.

There is a paucity of pertinent information relative to the effects of long-time storage on vulcanized rubber goods. Crude rubber is stored regularly and successfully, but this operation has been avoided with finished vulcanized articles because of the comparatively rapid deterioration which such goods usually undergo. Crude rubber is protected from light and dust and is not stacked in high bales lest the material in the lower portions of the bales become too tightly packed; these precautions are equally applicable to vulcanized goods. One anonymous writer (6) has noted an improvement in the quality of crude rubber during storage.

Gerald Reinsmith²

Peachey (7) examined the rates of absorption of gaseous oxygen by rubber at 85° and found that 4.10 atoms were taken up per C10H16 unit. Carpenter (8) deduced that an approximate relation exists between oxidizability, specimen size, and uniformity of oxidation for rubbers containing antioxidant. Finckendey (9) showed, by exposing rubber to sunlight in tubes containing air and other gases, that oxygen was necessary for tackiness to develop. The increase, on aging, of the gas permeability of rubber fabrics used in oxygen breathing apparatus has been investigated by Fieldner et al. (10).

Tener ct al. (11) observed the aging of soft rubber goods, particularly with regard to the degree of vulcanization, under the action of light, heat, oxygen, and moisture. Lascelles-Scott (12) recorded oxidizing agents, sulfur, and halogens as promoters of deterioration, and hydrogen, carbon dioxide, phosphorus, reducing agents, many metals, and weak alkalies as retarders.

The rate of physical deterioration of rubber is very greatly reduced by the exclusion of oxygen. Shelton and Winn (13) compared the aging of GR-S in a highly purified nitrogen atmosphere with aging in the oxygen bomb and the air oven and showed that oxygen plays an important part in the changes which take place. It has been estimated that in the absence of oxygen a well-made vulcanized rubber dielectric maintained at a temperature of 150° F, will remain serviceable for at least 30 years and probably much longer. However, storage at a high temperature in an inert gas tends to reduce the resistance of rubber to oxidation on subsequent exposure with the effect apparently similar to overvulcanization. Some rubbers are more affected than others (14).

The quantity of oxygen which may exist in the atmosphere surrounding vulcanized rubber goods without the rubber showing marked aging deterioration is questionable. Opinions as to the permissible amount of oxygen vary from a figure as low as 0.05% to a maximum of 1%.

Attack by Ozone

Crabtree and Kemp (15) exposed soft vulcanized rubber to outdoor weathering and concluded that the breakdown was due to light energized oxygen and action of atmosphere ozone. The deterioration of stretched rubber when exposed to atmosphere, which is characterized by the formation of cracks at right angles in the direction of stretch, has been shown to be due to attack by the ozone present in the atmosphere. Some of the synthetic rubbers, such as neoprene and "Thiokol," have been found to be very resistant to

The opinions or assertions contained herein are the author's and are not to be construed as official or reflecting the views of the War Department. Washington, D. C.

Numbers in parenthesis refer to the literature references at the end of this installment.

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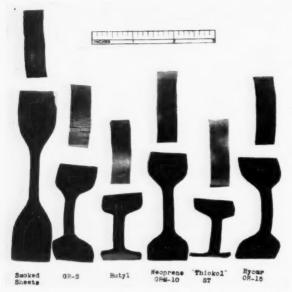


Fig. 1. Effect of Ozone (0.010% Concentration)-0.15-Cubic Foot of Air per Minute for Six Hours at 25° C.—Specimens Bent 180 Degrees

attack by ozone; while GR-S is slightly worse than natural rubber in this respect. Protection against ozone may be provided by the use of suitable waxes with those having a large microcrystalline content being of

maximum value (16, 17).

Another very successful method of providing surface protection has been to employ a flexible protective paint on the surface; this type of paint is usually prepared from bitumens and may contain antioxidants and light absorbent dyes. These paints can contain rubber, which should be excessively masticated or peptized so that stress decay may be as rapid as possible, and the film may thus itself remain free from strain although it can follow changes of strain in the vulcanized substrate. In the using of the paints, the article should first be stressed to the normal extent and then painted with at least two coats; if this policy is not followed, pinholing may result with consequent serious effects.

A more fundamental method of preventing ozone attack is to remove the ethylenic linkages on the surface without destroying the rubbery properties. Some progress has been made along these lines; for example, bromine will add to the double bond, but the resulting product is hard and relatively inelastic. If the bromination is carried out on the unstretched rubber, no protection is obtained because the film breaks on stretching, but if the bromination is carried out on the stretched sample, some protection against ozone attack may be afforded. The ideal method of preventing attack by ozone would be to avoid the introduction of polar atoms, such as bromine and oxygen, and to hydrogenate

the double bonds (17).

Sunlight Deterioration

According to Simpson (18), light renders rubber brittle. Weber (19) observed that light promotes oxidation; while Thomson (20) claims that sunlight and hot water do not act on rubber in the absence of oxygen. Light, however, is invariably harmful, and sunlight caused deterioration under paraffin coatings which exclude air. Articles in diffused sunlight during 34 months became friable, but were in good condition after three years' storage in air and darkness. Yamazaki (21) found that the dark color which vulcanized rubber acquires on aging is intensified by sunlight and also by higher degrees of vulcanization. Porritt (22) observed that oxidation occurs in absence of light if the material has been over-vulcanized, but that in absence of air tackiness does not develop on exposure to daylight. Asano (23) states that tackiness is accelerated by light which polymerizes and depolymerizes crude rubber in a carbon dioxide atmosphere where oxidation cannot take place. This action of light on vulcanized as well as crude materials has long been recognized by the great majority of investigators, and complete darkness is generally recommended as the best storage condition. Furthermore, according to Porritt (24), rubber tends to "recover" after storage

Dyes and colored pigment fillers have been commonly used in rubber compounds for protection against the harmful effects of light. One author (25) finds most of the convenient variables, including light, high or low temperatures, and moisture, detrimental. Blue and violet rays are particularly harmful; while red light is practically without effect. Bright colors are fairly effective as preservatives, and sulfur bloom may also be beneficial in this respect. Other authors (26, 27) have noted the preserving effects of bloom. Crabtree and Kemp (15) state that light-energized oxidation is independent of stress and controllable to any marked extent only by incorporation of opaquing fillers. Porritt (24) says that litharge and organic dves of suitable colors protect rubber in balloon fabrics against sunlight; the action is one of light filtration. Asano (28) keeps light-sensitive goods in yellow, red, or orange light or coats them with these colors. A combination of heat and light is highly deleterious; raw and vulcanized goods are equally sensitive to light, but the latter react more slowly (28). Weber (29), however, claims that red lead oxidizes rubber, and it is also claimed that pigments increase porosity and oxidation (22).

Effects of Temperature

Rising temperatures invariably result in increased deterioration. Samples (30) of vulcanized rubber during 36 days in air at 45° C. underwent a lowering of tensile strength; whereas similar samples were not appreciably altered during six months at 15-20° C Rubber (31) ages very slowly at 15-20° C. Ball (32) observed that deterioration at 70° C. in sunlight is three to five times as rapid as it is at -30° C. The velocity of hardening in light varies directly with the temperature and inversely as the wave length. Heat and light lower the free sulfur content. Sulfur bloom is usually credited with preserving qualities, but Williams (33) felt that free sulfur and oils were injurious.

There is some disagreement regarding the best temperatures for storage, barring a universal preference for relatively low temperatures.4 Anonymous authors have discussed proper temperatures (30) and the storage of rubber goods in winter (34). Terry (35) says that freezing is not harmful. Drgste (36) re-commended temperatures below freezing. At -10° F. Temperatures as low as -60° F. have been recommended. The cracking and crystallization of rubber and elastomers at -50° F. have been investigated (37). This behavior at low temperatures along with the necessity of maintaining some humidity in the storage atmosphere, a condition which is preferentially specified

¹ The effects of low temperature on the properties of rubber are discussed and references given in American Society for Testing Materials D832-46T.

by the large majority of investigators, largely rules out the use of temperatures much below freezing.

Moisture Effects

According to Drgste (36) moisture is neither favorable nor unfavorable; while Eaton (38) claims that wet rubber does not deteriorate on storage, and Stevens (39) is quoted by King (40) on the preserving effects of moisture. Humidities between 20 and 60% are favored dependent on the personnel consulted. Riehl has shown (41) that the permeability of dry rubber for gases is much greater than that of wet rubber and that cooking increases the permeability many times over. Stevens (39) noted that rubber ages faster in dry air, confirming an observation made earlier by Weber (42).

Boone (43) aged assortments of rubber bands during 43 months in water, in air, and in 5% solutions of salt; deterioration was slowest in the last, but was approximately the same for water and air. Specimens of a sample of rubber tubing (44) immersed during 15 months in water, in lime water, in a 1% soda solution, and in a 10% aqueous glycerine solution, and in a 2% boric acid solution showed successively decreasing breaking strengths of 35, 28, 28, 26, and 18 kilograms, respectively.

Stress Removal

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ge ed The necessity of storing rubber items in a completely unstressed condition has been emphasized. It is said that GR-S in darkness and in tension will crack. According to Crabtree and Kemp (15), atmospheric ozone attacks rubber only when the latter is under stress, and ozone aging is retarded to a considerable degree by additions of hydrocarbon waxes as long as the stress is static. Scott (45) observed folded inner tubes during five months and noted that permanent creases with traces of cracking formed at the folds. This damage by folding during storage was not paralleled by artificial aging tests. The weakening effects involve stresses intiated in the folds and also a flow of the rubber. Kelly et al. (46) noted that stretching speeds deterioration of rubber in ultra-violet and in sunlight.

Effects of Oils and Greases

The deleterious effects of oil on rubber have been described by a number of investigators (49), and the necessity of removing any oil or grease from rubber articles before storage has been noted. Schulze (27) has pointed out that any oil in the cotton of rubberized fabrics can effect deterioration, and Lascelles-Scott (48) indicated that petroleum oil shortens the life of rubber. Schwartz (49) stated that oil and reclaim may cause the oxidation of rubber in cables, and Thomson (20) attributed rapid oxidation and depolymerization to the presence of oils. Among the elastomers, "Thiokol," neoprene, and Perbunan N, according to Garner and Westhead (50), all show marked hardening on immersion in oils. The "Thiokol" was the least affected, and there was no indication of the extraction of free sulfur by the oil.

Microorganisms

The deterioration of vulcanized rubbers by microorganisms is only a remote and not a serious possibility. According to Zo Bell and Beckwith (51), "pure natural rubber is more susceptible to oxidation by microorganisms than compounded rubber products," and the action only occurs on continuous exposure to excessive static moisture. Bertrand (52) ascribes deterioration to oxidation and not to microorganisms. It is possible that the accelerators used in the manufacturing process may act as mold deterrents. Where mold growth does occur, the plasticizer used may be responsible. Where fabrics are coated or impregnated, it may be necessary to pretreat the fabric with a mold preventive compatible with rubber.

Accelerated Tests and Artificial Aging

The bulk of the literature which is even remotely pertinent to the preservation of vulcanized rubber goods relates almost entirely to methods of testing and artificial aging. Suitable tests for prediction of long-term aging effects under natural conditions of storage or service are lacking; consequently authors writing on rubber chemistry are frequently at variance in their recommendations relative to conditions and methods of preservation. Some authors are inclined to place full reliance on accelerated aging tests; e.g., Pellizzola (53) considers artificial (accelerated) aging of vulcanized rubber to be identical with natural aging and, therefore, that accelerated aging tests are dependable.

The accelerated aging procedures most commonly used are the Geer test, conducted in an oven of standard design at 70° C. (54) and the Bierer-Davis oxygen bomb test (55). Bierer and Davis claim that 16-24 hours' exposure of rubber articles to 300 pounds per square inch of dry oxygen at 50-60° C. produces a deterioration practically identical with several years of natural aging. The acetone extracts rises, and moisture and antioxidants retard the deterioration. These conditions are much more severe than are those of the Geer test.

Study by Newton and Scott (56) of the influence of rate of vulcanization, sulfur ratio, and nature of the accelerator on the relative rates of tensile deteriora-

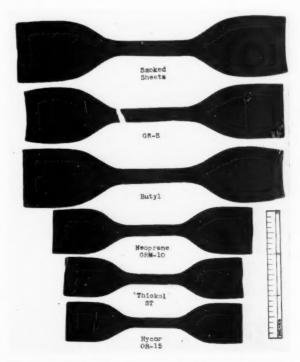


Fig. 2. Effect of Oil on Various Rubbers after Five Days' Immersion in 161° F. Aniline Point Oil (U.S.A. Specification No. 2-36D) at 158° F.

tion of natural rubber vulcanizates in the Geer oven and in the oxygen bomb at 70° C. showed the fallacy of using a single factor for converting oven to bomb aging periods or vice versa and that the relative natural aging resistance of widely different vulcanizates cannot be reliably assessed by either test. This limitation arises from the fact that the relative importance of oxidative decay and after-vulcanization varies from one type of mix to another and that the temperature coefficients of these processes are not necessarily the The facts are important in relation to the choice and application of accelerated aging tests for specification purposes, since these usually have to be applied to rubbers of unknown composition, liable to vary widely in their relative response to different aging conditions.

Spence (57) has pointed out that, while rapid deterioration may give the same products, these will not necessarily have the same structure as those of natural aging; in this connection he ascribes tackiness as "due merely to some change in the physical state of aggregation of the colloidal particles, or in the degree of molecular complexity of the caoutchouc molecule." Gottlob (58) considered tackiness as resulting from both chemical and physical changes in the rubber and observed that tacky rubber retains its tendency to become tacky after vulcanization. The oxidative origin of tack is indicated by its production on the surface of rubber articles through dipping them into hot solutions of potassium permanganate (59). King (40) described the Geer test and noted that samples are not hardened as in actual aging, but are definitely weakened. From a comparison of aging tests he arrived at the hypothesis that aging is simply additional vulcanization effected by oxygen and other factors. Longer milling on hot rolls gives a higher acetone extract because overworked rubber oxidizes very rapidly.

King's comparison of still and active aging in tires is of interest. In the spare tire the carcass is under strain from inside and takes a set along certain lines; when the spare tire is used, the stresses are opposite, and failure soon occurs. He concludes that some internal rearrangement has taken place within the

rubber itself.

That properly vulcanized rubber undergoes smaller changes on aging than does undervulcanized rubber was recognized by Byzov (60), who considered the changes a continuation of the vulcanization process. Synthetic rubber parallels this behavior; it polymerizes further on standing and becomes brittle.

Artificial vs. Natural Aging

Weber (61) lamented that the only property of crude rubber impaired by vulcanization is its stability. At normal temperatures and out of direct sunlight crude rubber stores without significant change over a period of many years; whereas vulcanized rubber begins to deteriorate in one year to two years or even more rapidly if it is under-or over-vulcanized. The use of stronger accelerators improves the aging properties of vulcanized compounds because of less depolymerization. Weber feels that antioxidants function by virtue of being oxidized themselves since their inhibiting action slowly diminishes.

Leon (62) has recorded an observation that crude rubber combines more rapidly with oxygen than does vulcanized rubber. According to Stevens (39), over-vulcanized rubber can be preserved for six to seven months at tropical temperatures in air saturated with moisture or petroleum vapors. The acetone extract does not increase, indicating that the rubber is protected

from oxidation and decomposition. Nevertheless the physical changes characteristic of "after-vulcanization" proceed normally, e.g., the increase in combined sulfur with aging which is well known. Oxidation is more rapid in dry than in moist air, and the acetone extract increases. Stevens concludes that when vulcanized rubber ages: (a) the tensile strength increases initially with a gradual reduction of breaking length; and (b) chemical deterioration occurs with a slight loss of sulfur. The extent of the chemical change depends on the coefficient of vulcanization (higher combined sulfur), the atmosphere, and the temperature. Mechanical deterioration is best followed by the increase in the acetone extract.

Attempts to correlate phenomena of natural aging with results of short-term aging tests are fairly numerous and have been discussed in the literature (63). Fisher (64) writes that "Ordinary aging requires months and even years before its effects can be recorded and compared." He describes the procedures for performing accelerated aging tests and concludes that "The methods of artificial or accelerated aging are of course only approximate and do not duplicate natural aging, but reasonable predictions can be made from them, since it has been found that two days in the oven or 12 hours in the oxygen bomb at 158° F. are roughly equivalent to about one year of natural aging,

as measured by loss in tensile strength.

Scott (65) found that the Geer test (70° C.) does not exactly reproduce the changes in tensile strength which accompany natural aging, that it tends to reduce the differences between good and bad aging rubbers, and that aging tests in the dark do not reveal sensitiveness to light cracking. He considers the drop in tensile a truer index of aging progress, an absorption of 0.75% of oxygen corresponding approximately with a 50% drop in tensile strength. Jacobs (66) concludes that natural aging in darkness is not duplicated by artificial aging, and that properly vulcanized compounds of suitable composition deteriorate very little or not at all. Gollop and Scott (67) showed that accelerated aging tests cannot be trusted to duplicate natural aging. They found that storing in the presence of ammonium carbonate caused abnormally rapid hardening and a drop in tensile strength, and that deterioration was less in sealed containers than in the open.

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Vulcanization of Rubber

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TULCANIZATION is a change in rubber which results in an increased resistance to deformation at ordinary temperature. This definition disregards entirely any chemical agents or chemical actions involved. It requires only that the rubber lose its plastic properties and become more resistant to compression, stretching, or swelling. Freeze resistance may or may not be affected; this depends largely upon the extent of any chemical attack which may be involved.

The earliest method of vulcanization, discovered by Goodyear over a hundred years ago, still remains the basis for essentially all vulcanization of rubber today. The only refinements which have been introduced consist in the addition of accelerators and accelerating accessories, and in a manipulation of the quantity of sulfur. All of the other methods, such as the use of sulfur chloride, peroxides, quinones, nitro compounds, and selenium, remain quite unimportant from a commercial standpoint.

The study of vulcanization, particularly with sulfur, has received the attention of many chemists, most of whom have differed in their final interpretation of the action. The earliest work on the nature of vulcanization was carried out by Henriques (1)3, who found that sulfur chloride combined chemically with the rubber, and the natural assumption was made that molecules of rubber were joined by means of sulfur. Weber (2) soon found that sulfur combined during hot vulcanization. Stern (3) found that the amount of sulfur combined was directly proportional to the time of heating and depended on the original concentration of sulfur. Whereas Stern conducted his vulcanization in solution, Hübener (4) obtained substantially the same results in a direct manner.

Many theories have been evolved to explain the mechanism of vulcanization, Höhn (5) and particularly Ostwald (6) believed it to be an adsorption phenomenon. This was soon disproved. The majority of investigators at present are inclined to favor some sort of chemical reaction which produces bonding of some type between molecules, either from cross-linking, by means of sulfur, by polymerization, or by molecular association. All of these theories recognize that in some manner the combination of sulfur is instrumental in the process.

Considerable work (7) has been done on combining sulfur with relatively simple organic molecules in attempts to gain some information regarding the manner of addition of rubber and sulfur. Although such work should not be discouraged, it should be pointed out that the reaction of sulfur with double bonds in a material such as rubber, which is lacking in mobility, can differ considerably from the reaction with double bonds in liquid materials.

Basis of Theories

The accumulated data obtained on the structure of rubber and on vulcanization have established a considerable amount of information to guide in the formulation of theories of vulcanization. The following changes have been determined:

TABLE 1. EFFECT OF MATERIAL ON RATE OF ADDITION OF SULFUR

Formula No.	A	13	C	1)	E	F
Smoked sheets	100	100	100	100	100	100
Sulfur	6	6	6	6	6	6
Di-o-tolylguanidine			1	1	* * *	
Zinc oxide				4.4.4		5
Zinc propionate			1	1	1	
Chloroacetic acid		1			4 / 4	

Cure at 300 ° F., Min.		C	mbined	Sulfur, %		
30)	0.80		3.50	2.75	0.63	0.48
(11)	1.62	0.25	4.85	4.02	1.15	1.00
90	2.15	0.34	5.06	4.48	1.60	1.76
120	3.17	0.50	5.25	4.75	2.13	2.50
190	1.10	1 2 2	5 5 2	5 27	2.75	4.08

1. Sulfur combines chemically in an irreversible manner. The temperature coefficient of about 2.5 indicates the reaction to be chemical (8, 9, 10). Stevens (11) extracted vulcanized rubber for nine weeks with no loss of sulfur after the first week. Treatment with such materials as alkalies, litharge, or sodium will not remove the unextractable sulfur.

2. Sulfur combines in simple rubber sulfur mixtures at a fixed rate which depends on the amount of sulfur originally present, until about 70% of the sulfur is combined; after that the rate decreases. Spence and Young (9) found that rubber containing 10% of sulfur, when vulcanized at 135° C., reacted at the rate of about 0.46% of sulfur per hour, until about 70% had been added; after that the rate became reduced. When vulcanized at 155° C. the rate was about 3.4% per hour until about 70% had combined. The rate depends on the original amount of sulfur. Spence and Young vulcanized rubber containing 37% of sulfur at 135° and found the sulfur to combine at a rate of 1.6% per hour, which is about 3.7 times the rate obtained with 10% of sulfur. Most accelerators alter the addition in such a manner that the rate is not uniform (10, 12, 13).

Although it is possible under severe conditions to cause the sulfur to react with elimination of hydrogen sulfide (14) it appears to add one sulfur to each double bond (9). The addition of more than 32% of the weight of the rubber is difficult. This amount corresponds closely to the addition of one sulfur atom to each double bond. However, there is still some doubt that all of the addition is in such a manner as to saturate double bonds (15, 16). It is possible that loss of double bond characteristics caused by change in chemical constitution could be responsible for failure of the addition agent to add to the double bond so that double-bond characteristics and not double bonds are lost.

3. The addition of sulfur destroys the elastic properties of the rubber molecule. The combination of about 8% of sulfur in a rubber-sulfur mixture produces a vulcanizate of almost no strength or extensibility. Continued addition produces a hornlike consistency and finally a brittle ebonite. If the sulfur atoms are evenly spaced along the rubber molecule, the combination of 8% of sulfur would mean that about 20 carbons in the chain, or five rubber units, separate the sulfur. Such rubber is of little value. Four per cent. probably approaches the limit for good vulcanized rubber, which means that the minimum chain of elastic rubber must contain at least 40 carbons.

4. The rate of addition of sulfur is decreased by strong acids and increased by bases; while soluble zinc salts (15) have a neutral or a slight retarding action (Table 1). Soluble zinc sales intensify the physical changes brought about by accelerators without altering the general nature of the change. tude of the intensifying effect varies with different accelerators.

In a very general way the relative accelerating activity of materials increases with the basic dissociation constant. has been shown by vulcanizing a mixture of 100 parts of smoked sheet rubber and six parts of sulfur at 284° F. in the presence of one part of various primary aromatic amines. The results are shown in Table 2, which lists the dissociation constant and the amount of combined sulfur after 120 minutes of cure. The table is divided into two groups, one of which lists weak and the other strong bases.

Although these figures indicate a general tendency for the strong bases to be the stronger accelerators, the relation within each group is not very good, and it would be necessary to con-

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 Bibliography references appear at end of article.

sider the structure of each compound separately to discover reasons for the difference in activity. Tertiary amines such as triethyl and tripropyl, which are strong bases, are very weak accelerators. Sulfur adds very slowly to rubber which is free of nitrogen (17).

Table 2. Relation between Dissociation Constant and Accelerating

	ACTIVITY	
Material	KB × 10 *	Combined sulfur.
No accelerator g-Xa hthylamine g-Xaghthylamine Audine m-Toluidine 1,7-Xa hthylenediamine 1,3-Xa hthylenediamine in Phenylenediamine p-Toluidine p-Toluidine p-Toluidine	0.02 0.05 0.06 0.08 0.17	1.07 1.36 1.87 1.70 2.68 1.86 2.58 1.96 2.40 0.98
Benzylamine Allylamine Diphenylguandine Di-a-tolylaminine Issamylamine Fineridine	4,600 7,000 7,000 49,000	4.52 2.62 4.02 4.34 5.42 4.87

5. The resistance of vulcanized rubber to deformation does not depend on the amount of combined sulfur (12, 15, 18). Bruni (19) is of the opinion that the minimum amount of combined sulfur required to initiate vulcanization is about 0.15%. Such an amount will not produce more than the beginning of vulcanization. One per cent, of combined sulfur may produce a bigh state of vulcanization if obtained in the presence of an active accelerator such as a thiuram disulfide. A high state of vulcanization cannot be obtained in the absence of accelerators with any amount of combined sulfur.

6. The physical effect of vulcanization can be overcome in most cases without alteration of the combined sulfur, and this change is reversible. It is known (20) that vulcanizable rubber cements accelerated with piperidinium pentamethylene dithiocarbamate will gel and, if treated soon after gelation, can be reduced to a liquid condition by dropping more of the same accelerator on the surface of the gel. The time required for gelation increases with the original content of accelerator; this indicates that vulcanization and peptization proceed simultaneously. Oxygen seems to be a minor factor since both gelatin and peptization take place in the presence of air. The solvent is unnecessary for the action since scorched stocks may be easily plasticized on the mill by incorporating this accelerator. Lightly vulcanized sheets of rul ber which are completely insoluble in benzene can be peptized at ordinary temperature by the addition of accelerators (20). The most active accelerators are generally, but not always, the most active peptizing agents. Mercaptobenzothiazole will cause the rubber to go into thin solution, but mercaptobenzothiazole in the presence of a basic activator is much more rapid in its action. Soluble accelerators, such as lead oleate, are also effective. The action of accelerators differs somewhat; some cause a general swelling and disintegration; whereas a few, such as benzothiazyl disulfide, cause the rubber to dissolve from the surface, probably because the accelerator is only slightly soluble in the

Fully vulcanized rubber may be brought into thin solution in a few days at a slightly elevated temperature (21, 22). Piperidine is a sufficiently active accelerator to peptize most stocks at about 95° C. For example, rubber vulcanized with three parts of sulfur, two parts of zinc oxide, and one part of di-o-tolylguanidine to a tensile strength of 4,000 pounds per square inch can be peptized to form a 5% solution in toluene, which is sufficiently thin to filter rapidly through ordinary filter paper. This very low relative viscosity would, according to the Staudinger equation, indicate a low molecular weight and a greatly degraded rubber. However the properties of the recovered rubber indicate that most of it is not in a greatly degraded condition.

The peptizing agent can be removed from such solutions by addition of alcohol. The coagulum which is thrown down still contains solvent and peptizing agent according to the partition between the rubber and alcohol. If the soft coagulum is repeatedly redissolved in benzene and reprecipitated, the peptizing agent can be effectively eliminated. Slight acidity in the alcohol favors more rapid removal of the peptizing agent.

The purified coagulum in many respects resembles polymerized chloroprene (neoprene rubber). Chloroprene can be polymerized until the polymerized units become too numerous; after

that the units approach one another too closely, and an insoluble gel results. If the partially polymerized mass is drowned in alcohol before this stage is reached, a coagulum results which, on removal of volatile material, will rapidly become insoluble and have vulcanized properties. In a similar manner the complete removal of solvent from the coagulum resulting from the peptized rubber will produce an insoluble material with the properties of vulcanized rubber. When the sulfurized rubber molecules approach one another too closely, they cannot be separated by pure solvents. Sheets formed by evaporating pure benzene solutions will show tensile strengths of several hundred pounds per square inch. Both the neoprene and the sulfurized rubber may again be brought into solution with peptizing agents.

Peptization

The peptizing of vulcanized rubber is the closest approach yet obtained to a reversal of vulcanization. In the case of neoprene the approach is close. In the case of rubber the approach is close if we consider the combination of sulfur as being only the step preliminary to vulcanization. The reversible removal of sulfur probably cannot be accomplished.

Peptized vulcanized rubber cannot be separated into fractions of different consistency by fractional coagulation (22). If a benzene solution is treated at slightly elevated temperature with alcohol until a slight cloudiness is developed, and if the solution is then cooled two or three degrees and held for a few hours, the most insoluble fraction will separate as a lower layer. Successive fractions may be obtained in this manner, and finally the remainder can be obtained by complete evaporation of the liquids.

The combined sulfur is not evenly distributed among the different fractions. The most soluble fractions contain from two to three times as much sulfur as the average for the original rubber. This tendency is greatest for unaccelerated stocks. The intermediate fractions, which constitute probably two-thirds of the rubber, contain less sulfur than the average for the sample. The least soluble fractions from unaccelerated stocks also contain slightly less than the average amount of sulfur. In the case of the few accelerated stocks which have been examined, the most insoluble fraction contains considerably more than the average amount of sulfur. This tendency is shown by the data in Table 3, which was prepared from compounds 1 and 3 of Table 6 in a previous article (22).

TABLE 3. DISTRIBUTION OF COMBINED SULFUR

	Incre	asing S	oftness a	nd Solu	bility
Fraction	D	E	F	H	I
Stock 1	(Unacce	lerated)			
e of total rubber in fraction			30.7 28.2	6.05 8.00	1.65 5.55
Stock 3	(Accel	erated)			
total rubber			41.0 29.3	29.3 19.3	3.6

Type of Combined Sulfur

The difference in character between the different fractions of rubber indicates that sulfur combines in more than one way. This possibility has been mentioned by others (15, 32). It is probable that different types of attack exist within a single molecule of rubber. The most soluble fractions have sufficient sulfur so that they should be greatly overvulcanized if the sulfur is all combined to produce vulcanization. Instead of being stiff and brittle, the material is soft and tacky, but still has enough elasticity to cause it to return to shape after being stretched. On the other hand the least soluble fractions are almost entirely lacking in tack and resemble rubber in a high state of cure. Accelerators favor the formation of the highly vulcanized fractions either by

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directing the sulfur to the correct type of addition, inhibiting the degrading type of combination, or reducing the time and temperature of vulcanization, which in turn reduces the degrading type of combination. Future studies to determine the type of reaction product formed with rubber and sulfur could well include fractions of peptized rubber.

Vulcanized rubber must be a mixture heterogeneous with respect to the various sulfurized molecules of which it is composed, although it might be quite homogeneous with respect to the distribution of sulfur through the rubber mass. It must consist of an intimate interlacing mixture of the various constituents, all of which together produce the properties of vulcanized rubber. The difference in properties between different vulcanized rubbers depends on the relative amounts and manner of assembly of the units.

The various phenomena associated with vulcanization are determined by the reactivity of the rubber molecule, which in turn is controlled by its structure and environment. The ordinarily assumed structure of rubber, consisting of condensed isoprene units with one remaining double bond for each unit, has been arrived at on the basis of the empirical formula, degree of unsaturation, X-ray spectographs, viscosity measurements, etc. The usual picture consists of long chains of 2,000 to 6,000 carbon units containing regularly recurring methyl groups and double bonds at each four carbons. The chains are folded and coiled together in a more or less accidental pattern as a result of free rotation around single bonds.

Rubber resists deformation by any method such as swelling, pressing, or stretching. In the case of attack by solvents the resistance often takes the form of limited swelling, which stops when the mutual attraction of rubber molecules equals the force of solvation, and the molecules remain in disordered arrangement. When rubber is stretched, the molecules appear to orient themselves in the direction of stretching while at the same time slipping, so that sufficient double bonds lie in the same plane to produce an X-ray diffraction pattern. Partly on the evidence of this pattern we deduce the structure of the double unit of rubber to be

Lack of Double-Bond Characteristics

This simple picture is not adequate to account for all of the chemical properties of rubber. Among these is the lack of double-bond characteristics. Although rubber will add bromine at the double bond with some ease, it will not add chlorine first at the double bond except when attacked by strongly electrophylic chlorine donors. In other cases the chlorine first attacks a methylene carbon with liberation of hydrogen chloride. Ordinary rubber is not attacked by oxygen or ozone unless in a strained condition. This lack of reactivity is not indicated by the simple olefin structure.

The lack of double-bond characteristics of many unsaturated substances—benzene, for example—is due to resonance. Although resonance might ordinarily not be expected to contribute greatly to the stability of simple olefinic compounds, nevertheless resonance can occur and, even in such simple olefins as propene, has a definite effect on the reactivity.

The magnitude of the stabilizing influence of resonance can often be estimated by means of the heat of

combustion. Several workers (24) have determined the heat of combustion of rubber, the most recent being Jessup and Cummings. They found a value of 45,274 joules per gram of purified rubber, which is equivalent to 1470 kg-cal, for the double unit

Data are also available for the calculation of the heat of combustion based on bond contributions (25). Since the molecular weight of the rubber molecule and the condition of the terminal groups are uncertain, it is necessary to base the calculation on a central portion of the molecule. For this purpose this double unit was used. The calculation is shown in Table 4.

TABLE 4. HEAT OF COMBUSTION OF RUBBER

Type of Bond	Contribution KgCal.	No. of Bonds	ontribution, KgCal.
С—Н	53.3	16	852.8
CC	50.8	8	406.4
C = C	118.8		237.6
		Heat of combustio	n 1496.8

These figures are not directly comparable because the calculated figures are based on gaseous material. It will be necessary to add to the determined value the heat of vaporization of a double unit of rubber. No such data are available, but most hydrocarbons will have a value of less than 100 calories per gram; for example, the heat of vaporation of hexylene is 93.5 calories per gram. If the combustion figure is corrected at the rate of 100 calories per gram, it would become 1470 + 13.6 or 1483.6 kg.-cal., leaving a difference of only 13.2 kg.cal. per double unit of rubber as the resonance energy. This is an indicated resonance energy of 0.92% of the heat of combustion. Although heats of combustion can be determined with greater accuracy than this, the resonance energy is so small that the result can be considered only as indicative.

Resonating Structures

Various resonating structures can be shown for rubber. Since olefin bonds are characteristically nucleophilic, and the double bond in rubber seems to be no exception, the important structure must be one which can produce a high electron density at some point. The following structures illustrate some of the possible conditions of resonance:

Since the rubber molecule is entirely hydrocarbon, it would not be expected to have any points of great permanent electron density. Such points of electron density will appear only by an electromeric displacement under the influence of an external field such as might

be supplied by an attacking agent.

In discussing the various structures, the chain carbons will be numbered from left to right. Structure A will produce an increased electron density on carbon 3, which will acquire a fraction negative charge. Under extreme conditions the 3 carbon could have a formal charge of -1, and the 2 carbon would act as a strongly electrophilic point with a formal charge of + 1. Such a condition must occur so infrequently as to be unimportant. In those cases where the demand for electrons on the 3 carbon is very great, it is improbable that the total demand will be met by the 2 carbon, but rather by a shift which affects other centers as well. In this way a relatively high nucleophilic point may be obtained without the production of a correspondingly high electrophilic point. The grouping about the double bond would become polar and electrophilic reagents could attack, but nucleophilic reagents would be ineffective.

Structure B is a type usually associated with activated gases. This shift would not create polarity and would not be induced by an external field. It is probably of

no importance in the rubber molecule. Structure C is also a latent polarity (polarizability) effect which can become important under the demand of an external field. In this case the 4 carbon in the methylene group will become activated. Dehydrogenation reactions should be favored. The arrow points to the right of the double bond because the effect of the methyl group attached to the 2 carbon in conjunction with the double bond should favor a shift in this direction. The analogous structure D is probably much less important than structure C.

Some evidence exists that an electronic shift to activate methylene groups is the most prevalent type in normal rubber. Chlorine first attacks rubber to form substitution products with the elimination of hydrogen chloride, and only by the use of such chlorinating agents as sulfuryl chloride will the attack be made first at the double bond. This might indicate that the latent polarity due to hyperconjugation is capable of very great development upon the proper demand but that, in the presence of less intense field effects, the greater electron density

appears on the methene carbon.

Structure E represents a condition that can exist in natural rubber, but not in polymers of unsubstituted butadiene. It is well known that the methyl group is capable, on demand, of electron release, and this effect can become pronounced in connection with doubly bonded carbon; for example, hyperconjugation between the methyl group and the double bond of propene produces a resonance energy approximately the same as that produced in butadiene by two conjugated double Hyperconjugation in the rubber molecule should, under the influence of an external field, make possible a considerably increased electron density on the 3 carbon. This seems to be the most likely point of attack by an electrophilic reagent with sufficient field intensity and the one by which the latent polarity could be most highly developed.

Postulation of Rubber Phenomena

On the basis of the resonating forms it is possible to postulate many of the phenomena displayed by rubber. It is first necessary to recognize that the rubber unit is not symmetrical, and for that reason a different sequence

occurs in passing along the carbon chain in different directions. In one direction the double bond precedes the methyl group, whereas in the other direction the reverse is true. It is reasonable to assume that in the rubber mass approximately an equal number of molecules will lie in each direction. Since the rubber units possess latent polarity, this might be developed to a minor extent by the proximity of two reversed resonat-

ing units.

· Such an occurrence in a semi-solid material would be more or less permanent, because the associated units could not trade partners as is possible in mobile liquids. This increased resonating state could account for the reduced double-bond characteristics of rubber. type of resonance comes into effect only on demand, and the proximity of a unit in the same position could have no effect. This means that, on stretching, the various units should seek out positions such that alternate layers of reversed polarity would result and an increasingly ordered arrangement of the molecules would be obtained. For this reason racked rubber should produce an X-ray fiber pattern. The attractive force is sufficient to maintain racked rubber in an extended position until the vibrational energy of the rubber molecules is increased by raising the temperature.

Ordinary rubber is known to be very resistant to oxidation under ordinary conditions. However, when rubber is placed under strain on a rubber mill, it rapidly oxidizes and becomes more plastic. It is difficult to believe that all the resonating centers in rubber would be paired; oxygen would be expected to attack unpaired centers, but is unable to do so. The heavier sulfur atom is capable of attack. Perhaps the field effect of the oxygen in conjunction with the small activation remaining as paired resonating units are being separated is sufficient to initiate attack. Whether the attack once completed actually ruptures the carbon chain or merely destroys the resonating center is not known. No evidence exists to show that either the latent or permanent

polarity of the rubber is altered.

Sulfur attacks rubber probably in one of the resonating forms C or E. In the first case, which may be important in the absence of accelerators, the attack would tend to replace hydrogen from the 4 methylene carbon to form either a sulfhydryl group or to eliminate hydrogen sulfide. Two carbons which might be in the same or different molecules could be united by means of sulfur. If carbons are united, the probability is greatly in favor of uniting two molecules. The attack on the 3 carbon of form E is probably the most important under vulcanizing conditions. The attack should be retarded by strongly electrophilic substances, such as strong acids, and should be assisted by nucleophilic substances, such as bases, unless the latter reacts to form relatively stable sulfur compounds.

The result of attack on the 3 carbon is not clear. The first step might form the mercaptan, which would be the desmotrope of the corresponding thicketone.

Such an arrangement would result in a permanent dipole and would maintain an active methylene group as a point of attack for more sulfur. Thioketones of low molecular weight are very active and polymerize readily to form ring structures containing sulfur bridges. Such D

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products are usually trimers although other polymers are known.

In spite of all the speculation and investigation into the manner of addition of sulfur, the problem is not vet solved. One of the most important contributions to the study is that of Selker and Kemp (23), who have reacted vulcanized rubber with methyl iodide. They conclude that a considerable amount of sulfide sulfur is present. This would indicate the linking of carbon atoms either inter- or intramolecularly by sulfur. Farmer (21) believes the presence of episulfides is unlikely. Thioketones also are reactive with methyl iodide and might be included in the sulfide sulfur determination. Paired dipoles containing thicketones could also unite by hydrogen bonding. Regardless of the nature of the attack, the result is that the reaction product becomes definitely polar and appears to have predominently electrophilic properties.

The sulfur in simple rubber-sulfur mixtures combines at a constant rate which depends on the original con-Various explanations, such as centration of sulfur. consecutive reactions, chain reactions, autocatalytic reactions, and micelle disaggregation, have been suggested as the controlling factor. The presence of predominently electrophilic dipoles in the rubber might activate other unsaturated groups in the immediate vicinity to facilitate attack by other sulfur. It is reasonably certain that attack of the 3 carbon by sulfur, especially if a thicketone group resulted, would activate the methylene carbon next to it. The remaining methylene groups between this and the double bond in the next group would in turn become somewhat more active. In this manner the reaction with sulfur would become more rapid as the attack on double bonds increased, and the rate of reaction could be maintained although the concentration of sulfur continued to decrease.

Rate of Combination of Sulfur

The presence of combined sulfur is sufficient to cause an increase in the rate of combination of sulfur. uniform blend of smoked sheets was used for the following experiment. Acetone-extracted rubber compounded with six parts of sulfur and vulcanized. It was then thoroughly acetone-extracted, and the combined sulfur was determined. This extracted rubber was then compounded with six parts of sulfur. A second compound was prepared from 100 parts of extracted smoked sheets and six parts of sulfur, and the two compounds were cured in the same mold for two hours at 140° C. Each compound was then extracted and the combined sulfur determined. The results in Table 5 show that the presence of combined sulfur has accelerated the further combination of sulfur. Since the combination of sulfur takes place at a uniform rate, it is assumed that the initial rate of addition will be indicated closely by a measurement taken when only about half of the sulfur has been consumed.

Table 5. Influence of Combined Sulfur on Combination of Sulfur

	e'c		Relative Rate		
Original	Final	Increase	-	of Combination	
0.0	2.65	2.65		1.00	
1.73	5.24	3.51		1.32	

The following calculation can be made from the data of Table 5. If we consider the concentration of rubber to remain constant in the reaction R+S=RS, the rate of reaction will vary with the concentration of sulfur. If 1.73 grams have combined in the fresh rubber compound, the concentration of dissolved sulfur will

be 4.27 grams, and the relative rate of combination should be reduced to 4.27/6 = 0.71 of the initial rate. Since 1.73% of combined sulfur in the present case has increased the rate by the factor 1.32, the rate should be $1.32 \pm 0.71 = 0.94$, or the rate should be approximately the same as at the beginning.

Action of Accelerators

If sulfur combines with rubber because certain points acquire sufficient electron density, then the primary action of accelerators must be on the rubber. Since the electron density is created only under the field of sufficiently electrophilic attacking reagent, the action of the accelerator must be simultaneous with, but cannot precede, that of sulfur. It could be possible for accelerators which are sufficiently nucleophilic to be less efficient because of competition with rubber in the reaction with sulfur. Such accelerators, which would usually be the more basic ones, would not be preferred for use in low surfur compounds. Accelerators should assist the release of electrons from the methyl group and promote the electron shift shown in structure E_{\star}

The action of soluble zinc salts is still speculative. Insoluble zinc salts seem to be quite ineffective. Soluble zinc salts in the absence of natural or added acceleration appear to have little effect or to have a slight retarding effect on vulcanization. It seems evident that the answer lies somewhere in the mutual or combined effect of accelerator and zinc salt. Perhaps the answer in some cases lies in the formation of Werner-type complexes which regulate the nucleophilic properties in the desired range. Cadmium and sometimes mercury, when substituted for zinc, produce activation, but in different degrees. Indications exist that zinc cannot be removed completely from vulcanizates without destroying them, and further indications have been found (20) of a condensing or polymerizing effect of zinc salts.

No adequate theory of vulcanization has vet been advanced and probably will not be until better information in regard to the manner of combination of sulfur is available. The apparent presence of sulfide sulfur is strongly indicative of cross-linking of the various molecules by means of sulfur, and yet sulfide sulfur could be present without cross-linking. If the sulfur first attacks a methylene carbon, the most probable result would be the formation of a sulfhydryl group, and coupling could take place only by oxidation. If a doubly bound carbon of paired bonds is attacked to form a thicketone, bonding might take place by polymerization between two such bonds. If paired bonds are attacked to form any permanently polar structure, the linking between molecules may consist of nothing more than the pairing of such more strongly polar structures. It seems most logical that any intra-molecular bonding must take place at the olefinic points and that any sulfuration of methylene carbons is purely destructive. Methylene attack probably is most rapid when accelerator influence is absent, as in unaccelerated stocks or on overcure with expendable accelerators. In this connection the data of Table 6, taken from the previous paper (22), are of interest.

TABLE 6. RELATION BETWEEN COMBINED SULEUR AND PHYSICAL PROPERTIES (22)

	onsile Strength	
Accelerator	Lh./Sq. In.	Combined Sulfur, %
None, 60-min. cure	175	1.92
None, 120-min, cure		3.85
Butyraldehyde butylamine		2.38
Di-o-tolylguanidine		2.25
Tetramethylthiuram disulfide	. 1875	0.34

The stocks containing no added accelerator have very

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little increased stiffness, which shows that most of the sulfur has combined in an ineffective manner. combined sulfur in the accelerated stock has produced a high stiffness which increases with the combined sulfur; this indicates that much of this sulfur has produced bonding. Of the three stocks, the softest one cannot be peptized with piperidine; this indicates a greater possibility of covalent bonding rather than association through dipoles or hydrogen bonds.

The ability of nucleophilic materials to peptize rubber in benzene solution is an indication of association through paired dipoles. Since the dipole is essentially electrophilic-that is, the electron deficiency is more localized than the density-the dipolar attraction can be overcome by the presence of a more strongly nucleophilic substance. Upon the removal of such substance, many of the paired poles can again reform, and the rubber is once more firm and insoluble. The activity of peptizing agents may be quite different from their accelerating activity.

The study of vulcanization should be encouraged particularly because of its importance to the synthetic rubber industry. The natural rubber industry developed as an art largely because of the adaptability of the natural product. Most synthetic rubbers, other than chloroprene polymers, refuse to vulcanize satisfactorily in the absence of large amounts of various powders. Perhaps the present synthetics will be vulcanized satisfactorily in the future. It is certain that a better understanding of the process by which natural rubber is vulcanized would assist in finding better methods of vulcanizing synthetics and in the formulation of synthetics which are more vulcanizable.

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Brabender Plastograph

(Continued from page 64)

Conclusions

With suitable modifications the Brabender plastograph can be used to advantage in studying, on a small scale, the factors which influence the changes in consistency of rubbers during their mastication.

Typical results reported herein show that the temperature coefficient of the rate of breakdown for natural

rubber is 1.47 and for GR-S, 1.36.

The rate of softening of butadiene-styrene copolymers is shown to depend (among other factors) on the original consistency of the rubber and the type of modifier used in polymerization.

The influence of commercial peptizing agents on the rate of softening of natural rubber, GR-S, and GR-I at 150° C. is shown.

The reproducibility of the mastication test was found to be good.

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EDITORIALS

The Business Outlook — Present and Future

THE present and future direction of the trend of business and industrial activity both in this country and throughout the entire world is probably the most important question in the minds of leaders in industry, government, and labor and the general public everywhere at the present time. More than two years have elapsed since the end of World War II, and in this country at least, goods that have long been scarce have reappeared in increasing quantities in the nation's stores from month to month since the latter part of 1946. Commodity prices, kept reasonably in line by government controls until about a year ago, have risen rapidly, but now may have passed their peak. As stated by Earl Bunting, president of the National Association of Manufacturers and president of the O'Sullivan Rubber Corp., in his appearance before the Joint Committee on the Economic Report, in Washington recently, we have all observed the overwhelming pressure of wages upon prices and of prices upon wages.

"It is difficult to say which causes which to move, unless we select a somewhat arbitrary starting point for our discussion, but I think we will all concede that wages and prices tend to move hand-in-hand in a period of broad and basic economic changes. There are, of course, various important lags and leads, but wages never can get very far out of line with prices for any long period of time," Mr. Bunting added.

"Production is the real answer to real wages," Mr. Bunting continued. "We cannot have things which we do not produce. We get more only by producing more."

Profits, national income, foreign trade, and money and capital were also discussed by Mr. Bunting in his talk, which had as its purpose calling attention to the need of national unity and federal tax law revision, if the capital to insure future production, employment, and progress is to be obtained.

Reference was made to the fact that business profits are not always in the form of cash and that a large part of the profits in 1946 were due to increases in inventories and the higher prices of these inventories. The relative shares of the national income received by various parts of our economy, such as, compensation to employes, about 67%; corporate profits, 6% to 7%; unincorporated businesses, 16%; interest, net rents, and royalties, before 1939, 10 to 17% and now 6% to 8%, were recorded to show that we are now returning to the "normal" type of distribution of the national income following the maladjustments of the war years.

On foreign trade it was emphasized that without a soundly based international trade the world cannot prosper, but that international trade cannot raise living standards unless each country first puts its own house in order. We can do our greatest share for world rehabilitation and progress by keeping our own house in sound and prosperous condition, and this is our first and our paramount task, Mr. Bunting said.

In conclusion it was stated that there is much reason today for the people of this nation to look forward to the future with confidence, but it would be a serious error to assume that we are now in a position to rest on our oars. Two major problems *must* be solved if the nation is to continue to move forward. The first is to make the necessary changes in our tax laws to provide the capital formation essential to continued growth of production and the provision of jobs for our growing labor force, and the second is for all of us to forget our selfish group interests and, in the spirit of genuine unity, put our shoulders to the wheel.

We are in hearty accord with the opinions expressed by Mr. Bunting, and we think it is of equal or even greater importance to see that this type of discussion is given the widest possible circulation. Time is running out, and if the United States is to continue at its present high level of production, national income, and prosperity, we certainly must have a general lowering of government spending and taxing, even though, at the same time, we are called upon to provide for the expenditure of needed large sums for world-aid plans in order that the growth of a healthy postwar trade will not be retarded.

According to information contained in a series of charts recently made public by Dun & Bradstreet, one of which is entitled, "The Effect of 3 Wars on United States Prices," we may have another year or more at the present price level if comparison of conditions at present with those during the years following the Civil War and World War I mean anything. On the other hand, as far as the wholesale price indices for certain key commodities are concerned, a comparison of the figures for the period two years after World War I and those in effect now, for food, farm products, building materials, and metal products, seems to indicate that we have about reached the peak for these items, and a general lowering should take place soon. However, comment by Dun & Bradstreet in this connection is pertinent:

"Whether the price curve will flatten out in 1947-48 is conjectural from the present vantage point. The tugof-war between costs and profit margins, between supply and demand goes on without a decision. Whether our economy will follow the postwar pattern of other wars, or whether we can find a level of equalized tensions without too much pain in our business anatomy is still uncertain. This much is apparent. The business health of the nation remains vigorous and reveals a continuing stamina toward a variety of shocks."

Let us hope that this business health continues vigorous and we want again to repeat the call of Mr. Bunting for unity in this country since it seems that the future of the whole world depends on a strong, united America to insure peace and prosperity in the years to come. We may not achieve "One World," but prosperity in most of the world now depends on prosperity in the U. S. A.

Scientific and Technical Activities

A. C. S. Meeting at New York

THE meeting of the American Chemical Society held in New York, N. Y., September 15 through 19, was attended by tember 15 through 19, was attended by about 11,000 members and guests. At the general meeting of the Society, the evening of September 15, W. A. Noyes, president of the A. C. S., presided and awarded the various medals and prizes, including the Award in Pure Chemistry to Glem T. Seaborg, of the University of California, and the Priestley Medal to Warren K. Lewis, of Massachusetts, Institute of K. Lewis, of Massachusetts Institute of Technology. In his presidential address. Dr. Noyes discussed "The Mechanism of Photochemical Reactions.

Meeting of the Rubber Division

The Divison of Rubber Chemistry held The Divison of Rubber Chemistry held four technical sessions, beginning on the afternoon of September 17 and ending at noon on September 19. In his opening remarks on September 17, W. W. Vogt, of Goodyear Tire & Rubber Co. and chairman of the Division, called attention to the continuing growth of the Division of Rubber Chemistry and complimented it on the calibre of the papers presented and the interest and enthusiasm shown by the members in the work of the organization. Abstracts of the paper given before the technical sessions appeared in our August

issue, page 646.

the business meeting, the afternoon of September 17, it was announced that as a result of a letter ballot election, officers and directors of the Division for the coming year were as follows: chairman. H. E. Outcault, St. Joseph Lead Co.; chairman-elect, H. I. Cramer, Sharples Chemicals, Inc.; secretary, C. R. Haynes, Binney & Smith Co.; and treasurer, C. W. Christensen, Monsanto Chemical Co. Directors elected from the areas of the sponrectors elected from the areas of the sponsored local rubber groups were: Akron, J. H. Fielding, Goodyear; Boston, J. C. Walton, Boston Woven Hose & Rubber Co.; Buffalo, H. E. Elden, Dunlop Tire & Rubber Corp.; Chicago, H. A. Winkelmann, Dryden Rubber Co.; Connecticut, J. H. Ingmanson, Whitney Blake Co.; mann, Dryden Rubber Co.; Connecticut, J. H. Ingmanson, Whitney Blake Co.; Detroit, G. R. Cuthbertson, United States Rubber Co.; Los Angeles, P. W. Drew, Goodyear; New York, S. Collier, Johns-Manville Corp.; Northern California, R. E. Morris, Mare Island Naval Shipyard; Philadelphia, B. S. Garvey, Jr., Sharples Chemicals; Rhode Island, L. A. Murray, Jr., U. S. Rubber.

Other members of the executive committee are: Mr. Voot, the retiring chair-

mittee are: Mr. Vogt, the retiring chairman; A. M. Neal, E. I. du Pont de Nemours & Co., Inc., the unsuccessful candidate for chairman-elect; and C. C. Davis, Boston Woven Hose, and S. G. Byam, du Pont, editor and advertising manager, respectively, of Rubber Chemistry and

Technology.

The report of the chairman of the membership committee, Mr. Fielding, stated that the work of this committee during the past year had resulted in 68 new members of the A. C. S., 341 new members of the Rubber Division, and 83 new associate members of the Rubber Division. The total number of new Division members was, therefore, 424. The total membership of the Division at present consists of 1,615 regular and 26 associate members, an increase of 257 since the same date last year. In view of the fact that this



Harry E. Outcault

increase is smaller than the total new members it is obvious that there have been some withdrawals, but the net effect indicates a healthy growth of the Division.

It was also announced that the execu-tive committee of the Rubber Division had decided to sponsor and publish a book similar to "The Chemistry and Technology of Rubber" by Davis and Blake, issued in 1937. This new book will deal with synthetic rubber and will have as its board of editors, Mr. Davis, R. F. Dunbrook, of the Firestone Tire & Rubber Co., and G. S. Whitby of the University of Akron.

As a second project, the Division is planning the establishment of a complete and comprehensive library on rubber chemistry and technology, to be located at the University of Akron, Akron, O. Dr. Garvey is the chairman of the committee for this undertaking. Other members are: Miss P. Hamilton, librarian, Firestone; Miss Leora Straka, librarian, Goodyear; Frank Kovacs, Seiberling Rubber Co.; Ralph Appleby, du Pont; H. M. Stevens, B. F. Goodrich Co.; H. C. Tingey, U. S. Rubber; and Miss Dorothy Hamlin, libra-

rian, University of Akron The Rubber Division is planning to meet with the parent Society in Chicago, Ill., during the week beginning April 19, 1948. The Division will have sessions on April 21, 22, and 23 at the Hotel Sherman, and members were advised to give early consideration to the preparation of papers to be presented at this meeting.

The Division Banquet and Suppliers' Cocktail Party

The banquet of the Rubber Division was held in the grand ballroom of the Hotel Commodore on the evening of September 18 and was preceded by the suppliers' cooperative cocktail party, held in the adjoining smaller ballrooms. This type of affair, first held at the Cleveland meeting last spring, will most likely become a regular feature of the future Rubber Division meetings, judging from the enthusiastic reception again accorded this party at the New York meeting. Much credit is due the chairman of the committee in

charge of the suppliers' party, Jack Hamilton, of Binney & Smith, and the other members of the committee for the success of this event.

The banquet of the Division, attended by about 900 members and guests, will also be remembered as one of the most enjoyable features of the New York meet-ing. The meal, the service, and the en-tertainment, provided under the direction of the local committee on arrangements under the chairmanship of Mr. Collier, were all of high order and were received with the usual evidence of appreciation by those in attendance. Honored guests at the head table at the banquet were Alden H. Emery, secretary and business manager of the A. C. S., and Walter J. Murphy, editor of Industrial and Engineering Chemistry and Chemical and Engineering News.

Papers before Other Divisions

Because of the large number of papers given before the New York meeting, there were many papers of interest to the rubber and associated industries presented at meetings of other Divisions. Most important, probably, were the papers given at the High Polymer Forum, sponsored by several Divisions of the Society, including the Division of Rubber Chemistry.

Abstracts of these papers follow:

Mass Spectrometric Investigation of

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the Thermal Decomposition of Polymers. With the aid of the mass spectrometer a pyrolytic study of the nature of polymers has been carried out. The method consisted essentially of pyrolysis of a solid followed by molecular distillation. Yields of monomer were obtained as well as analysis of the volatile products; however, some polymers decomposed into so many substances that the computation of the analysis from the mass spectra must await the calibration of the spectrometer

for many rare compounds.

A consideration of the differences between vinyl and diene polymers leads to a method of estimating monomer yield on the depolymerization of a copolymer from a knowledge of the yield from the simple polymer. For example, consider the case of polystyrene and GR-S. From polystyrene the yield of monomer by the method presented was 33% by weight. If polysty-rene is assumed to have a head to tail structure and the chain ends are neglected, it can be seen that there are two ways of splitting the polymer to give styrene. If styrene units are isolated between butadiene units as in GR-S, only one way exists of splitting out styrene. Therefore the yield from GR-S should be one-half that expected on a basis of the known yield from polystyrene and the weight of styrene in GR-S. Since the yield of styrene styring in one of the was 33% from polystyrene, and GR-S contains 23.5% by weight styrene, recovery from GR-S should be 23.5% \times 0.33 \times ½ = 3.9% styrene; actually the yield was 3%. This would be a confirmation of the head to tail structure assumed and hence be a test for such a structure.

It is also pointed out that from the probabilities of various sequences in a co-polymer (PBs₁B being the probability of a sequence of iS units) which can be calculated from copolymerization theory, an expression can be obtained giving the yield to be expected from a copolymer of any composition. The expression follows.

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Yield (from copolymer of styrene-diene type) = Yield (from polystyrene) x

$$P_{BSB} \Sigma_{\underbrace{2i-1}_{2i}}^{\underline{i} = \infty} P_{SS}^{\underline{i-1}}$$

$$, \underline{i = 1}$$

L. A. Wall, National Bureau of Standards, and A. K. Brewer, U. S. Navy Department, both of Washington, D. C. Pyrolytic Fractionation of Polystyrene

Pyrolytic Fractionation of Polystyrene in a High Vacuum and Mass Spectrometer Analysis of Some of the Fractions. Pyrolytic fragmentation and fractionation of polymers in a high vacuum and identification of the fragments can serve as an effective means of studying structure and properties of the polymers under investigation. A method and apparatus have been developed for carrying out such fragmentation, using polystyrene as an example.

The method consists in heating a 25- to

The method consists in heating a 25- to 50-mg, sample of polystyrene in the form of a thin layer on a platinum tray, in a glass apparatus evacuated to about 10-6 mm, of mercury. Pyrolysis begins at about 350° C, and is almost complete at 400° C. The products of pyrolysis are collected as fraction I, residue in the Pt. tray, fraction II, non-volatile at room temperature, fraction III, volatile at room temperature, fraction IV, non-volatile at room temperature and depositing on the wall of the apparatus and, finally, fraction V, a gas not condensable at the temperature of liquid air.

air.

Fraction I was found to have an average molecular weight of 2500 as determined by the freezing point lowering method, in a solution of cyclohexane. Fraction II, analyzed by the same method, was found to have a molecular weight of 265, thus indicating that it consists mainly of the dimer, trimer, and, perhaps, some tetramer. Fraction IV was not analyzed, but it is assumed that it is similar in composition to fraction II. Mass spectrometer analysis of fraction III showed it to consist on the average of 94.5 mole % styrene, 5.4 mole % toluene, and traces of ethyl benzene and methyl styrene. Similar analysis of fraction V showed it to consist of the amount of oxygen originally present in the polystyrene. Maximum yield of styrene, at 420° C. was 40% by weight of the original sample of polystyrene as a function of time follows closely an exponential curve. S. L. Madorsky and S. Straus, Bureau of Standards.

Viscosity Changes in Chloroprene Emulsion Polymerization.

and yield point of a polymerizing chloroprene emulsion rise during the first stages of the process and drop to a fixed value as the polymerization is completed. The magnitude of the viscosity and yield point change, and the conversion at which the maxima in these properties occur, as measured by a Mooney-Ewart conicylindrical viscometer, depends upon such factors as the concentration of the starting emulsion, rate of polymerization, polymerization temperature, concentration, and nature of the soap. The relation between viscosity and solids content in latices from emulsions of varying concentrations in which the soapmonomer ratio is kept constant is the same as that in a polychloroprene latex concentrated by distillation. The peak viscosity of a polymerizing emulsion is reduced by stripping the monomer from the latex short-stopped at this point and is restored by replacing the monomer or adding any organic solvent that swells the polymer. The addition, however, of a non- or weakly swelling solvent causes only a small increase in viscosity. The addition of chloroprene monomer to a latex at complete conversion likewise has little effect upon the viscosity, owing to a higher gel content or lower swelling index of the polymer. Methods of reducing the viscosity changes during polymerization to gain better process control are suggested. The viscosity change during a polymerization by the mechanism of the micellar hypothesis as well as the viscosity change on concentrating a latex results from interparticle dimensional changes. G. W. Scott and H. W. Walker, E. I. du Pont de Xemours & Co., Inc., Wilmington, Del.

Isomerism in Vinyl Polymers. Experi-

Isomerism in Vinyl Polymers. Experimental evidence of isomerism in polyvinyl isobutyl ethers obtained by varying conditions of polymerization has been presented to the Division of Paint, Varnish and Plastics Chemistry at Atlantic City meetings of 1946 and 1947 from this laboratory. The present paper comprises a review of these results from a theoretical point of view, together with some application of these ideas to other vinyl and related polymers.

If branching and variations from head to tail arrangement are excluded, the differences between the rubber-like and nonrubber-like types of polyvinyl isobutyl
ethers can be attributed to spacial isomerism—that is, to variations in the distribution of alkoxy groups along the chains.
The spacial isomerism may be a rightand left-hand isomerism analogous to cistrans (made possible by restriction of rotation by the bulky isobutoxy groups) or
isomerism involving asymmetric carbon
atoms.

In connection with the study of isomeric polyvinyl alkyl ethers we found that when substituted ethylenic polymers are grouped according to the opportunity for spacial isomerism, and according to the size of the side-chain substituent, interesting relations can be shown to the degree of crystallinity and the character of the X-ray patterns. A classification of vinyl and related polymers based on these effects is proposed. That such a classification is possible seems to support the hypothesis that, in determining the degree of crystallinity and fibering in high polymers, branching and variations from head to tail addition are of relatively secondary importance, as compared to the regularity of side-chain substituents.

The X-ray patterns of a number of polymers are discussed in relation to spacial isomerism and the proposed classification. Among the materials examined are polyvinyl methyl ethers, polyvinyl isopropl ethers, polyvinyl pyrrolidones, and polyvinyl carbazoles. S. T. Gross, C. E. Schildknecht, A. O. Zoss, General Aniline & Film Corp., Easton, Pa.

Polymer Plasticizer Interaction. E. K. Rideal.

Diradical Initiation. Phthalyl Peroxide as a polymerization initiator. Phthalyl peroxide, a polymeric peroxide, has been studied as a polymerization initiator. From an examination of the structure of the peroxide it appears as though it should decompose into diradicals and a few monofunctional radicals—i.e., two monofunctional radicals per polymeric peroxide chain. It was thought, therefore, that phthalyl peroxide may initiate polymerization by a diradical mechanism. If such is the case, the polymers produced should have a degree of polymerization of the same order of magnitude as the uncatalyzed thermal polymerization and higher than those made using benzoyl peroxide as an initiator under the same polymerizing conditions. In addition, the rate of polymerization should be of the same order of magnitude as the benzoyl peroxide-catalyzed polymerization.

The experimental data using styrene as the monomer at 150° C, in evacuated sealed tubes partly hear out these expectations. The rates, using phythalyl peroxide as an initiator, are higher than the thermal uncatalyzed polymerization. Comparing the rate curve of the pythalyl per-oxide with the benzoyl peroxide runs. under the same experimental conditions, it is observed that the rates using the latter are greater at the beginning of the reaction, but the same time, six hours, is necessary to reach 90% conversion. The faster reaction rate at the beginning of the reaction is to be expected with benzoyl peroxide under these experimental conditions—i.e., 150° C. The degree of polymerization, as measured by the intrinsic viscosity, shows that in the case of the thermal polymerization, the intrinsic viscosity did not vary with conversion and had a value of 0.82 over the conversion range. In the case of the phythalyl peroxide-catalyzed polymerization, the intrinsic viscosity increased with conversion from a value of 0.5 to 0.8 at approximately 70% conversion, after which a slight drop occurred. The intrinsic viscosities in the case of the benzoyl peroxide run remained constant with conversion at a value of 0.40. H. A. Shah, F. Leonard, A. V. Toholsky, Princeton University, Princeton, N. J.

Cumene Hydroperoxide in a Redox Emulsion Polymerization System. A "redox system" based on cumene hydroperoxide (2,2-dimethylbenzyl hydroperoxide) has been found remarkably effective for initiating emulsion polymerization with disproportionated rosin soap (Dresinate 731) emulsifier. It gave 10- to 20-fold faster polymerization rates for a variety of vinyl compounds—for example, styrene, methyl, methacrylate, butadiene, butadiene-styrene, butadiene-acrylonitrile, and vinyl chloride—than did the conventional potassium persulfate initiator. In addition, it was superior to similar redox systems based on the common peroxides and per salts. The polymerization rate curves were linear and free from induction periods.

The other components of this cumene hydroperoxide redox system were a reducing agent, such as fructose, and a soluble iron salt, such as ferric or ferrous pyrophosphate.

phosphate.

The copolymerization of butadiene and styrene (GR-S) with this system gave 72% conversion in two hours at 40% C, or in 23 hours at 15% C. The mercaptan modifier was not required for the initiation process, but it was necessary to obtain a soluble and processable rubber. Laboratory tests indicated that the physical properties of the synthetic rubber prepared at either 40 or 15% C, were similar to commercial GR-S-10.

Kinetic studies of the important variables for GR-S polymerization at 40° C. showed that: (1) the polymerization rate was decreased fourfold without deviating from a linear rate curve by decreasing the fructose concentration from the usual 0.5-part per 100 parts of monomer to 0.02-part; (2) the major effect of the iron component was to eliminate initial periods of very slow polymerization; above a concentration of about 10 p.p.m. it had little effect on the final polymerization rate; and (3) the variation of the hydroperoxide concentration from 0.04-part to 1.4 parts had only a small effect on the initial polymerization rate, but with 0.04 to 0.1-part the polymerization was incomplete owing to peroxide exhaustion. E. J. Vandenberg and G. E. Hulse, Hercules Powder Co., Wilmington, Del.

The Emulsion Copolymerization of Methyl Isopropenyl Ketone with Butadiene. The emulsion copolymerization of methyl isopropenyl ketone with butadiene

has been investigated to determine the effects of emulsifier, modifier, temperature, ratio of monomers, and pH on the rate of reaction and viscosity of the copolymer. It was found that the reaction could be carried out using a wide variety of emulsifiers and a pH ranging at least from 3 to 10. Mercaptan modifiers had the usual effect on the molecular weight and were necessary to produce a soluble, plastic polymer. The polymerization rate was proportional to the per cent, ketone in the monomer mixture and was increased about threefold by raising the reaction temperature from

In comparing the copolymerization with that of styrene and butadiene, the chief points of contrast are: (1) the much faster rate (about four times that of a comparstyrene-butadiene copolymerization) and (2) the formation of polymers which are completely soluble, even at conversions of 80% or more. C. W. Gould and G. E.

Properties of Vulcanizates of Methyl Isopropenyl Ketone-Butadiene Copolymers, C. W. Gould, L. O. Amberg, and mers. C. W. Gould, G. E. Hulse, Hercules

Use of Pure Resin Acid Soaps in GR-S Polymerization. Complete polymerization rate curves have been obtained at 50°C, for a GR-S-type system employing as emulsifiers the sodium soaps of each of the pure resin acids isolable from natural rosin. From the results presented it is evident that the resin acid soaps having a conjugated diolefinic structure retard or inhibit polymerization. Resin acid soaps without aliphatic unsaturation show the greatest activity in emulsion polymerization; while those having non-conjugated unsaturation are somewhat less effective. With sodium tetrahydroal ictate a linear relation was found to exist between the emulsifier con-centration and the average polymerization rate within the range of one part to 10 parts of soap per 100 parts of monemers. Below a critical concentration of about one part of soap the rate fell off rapidly. Employing this same soap, the rate was found to be independent of the catalyst concentration within the range of 0.00- to 0.6-part of persulfate per 100 parts of monomers. Using sodium dehydroabietate as an emulsifier, an increase in temperature from 40 to 50° C, increased the polymerization rate by a factor of 2.06, corresponding to an overall activation energy for the reaction of 14,500 calories per mole. J. L. Azorlosa,

The Occurrence of Head-to-Head Arrangements of the Structural Units in Polyvinyl Alcohol and Acetate. Polyvinyl alcohol prepared by hydrolyzing polymerized vinyl acetate undergoes rapid degradation when treated with reagents such as periodic acid, sodium periodate, and lead tetraacetate. The intrinsic viscosity drops within a few minutes at room temperature to a low value, after which it shows no further significant change for many hours. The final intrinsic viscosity is independent

of concentration of reagent.

The degradation is attributed to the presence of 1.-2 glycol structures arising from occasional "abnormal" addition of monomer in the chain growth step. The proportion of head-to-head (1,2) arrangements, and hence the proportion of abnormal addition, can be computed from the molecular weights before and after de-gradation. The molar percentages (based on the —CH₂CHOH— unit) of 1,2 ar-rangements appear to depend solely on the temperature at which the vinyl acetate was polymerized, varying from about 1% to for polymerization temperatures from 25 to 110° C. The activation energy for the abnormal addition reaction is computed from these results to exceed the activation

energy for the normal addition by about 1400 cal. The steric factor for the abnormal reaction is about one-eighth that for the normal addition. P. J. Flory and F. S. Leuner, Goodyear Tire & Rubber Co.,

Birefringence as a Function of Identity Period in High Polymers. In the past few years several investigators have noted in a general way that a relation exists between birefringence and chemical structure of high polymers. The present investigation has carried this relation further to the point where birefringence and enemical structure can be correlated in a

mathematical formula.

It had been shown previously that birefringence and orientation have a straightline relation to each other for any one polymer. From polymer to polymer the amount and sign of birefringence vary at maximum orientation. Optically negative polymers possess identity periods short in comparison to the width of the monomer unit. On the other hand, the optically positive polymers possess identity periods longer than the monomer unit is wide. A plot showing the birefringence of eight polymers, as a function of the ratio of identity period to monomer unit width gives a straight line which fits the equa-

identity period Birefringence=0.015

m momer unit width

This relation will be applicable in determ ning the amount of copolymerization between two monomers, assuming the monomers to have at least some dimensional difference. Another application will be in measuring the amount of L2-and L4- polymerization in conjugated monomers. R. J. Keid, G. P. Rowland, W. G. Mayes, Firestone Tire & Rubler Co., Akron.

Dependence of Elastic Properties of

Vulcanized Rubber on the Degree of Cross-Linking. The theory of rubber elasticity relates the force of retraction at a given elongation to the degree of cross-linking of the polymeric structure comprising the rubber vulcanizate. No wholly sat-isfactory experimental verification of the of this theoretical relation has been offered heretofore owing principally to the difficulty of quantitative determination of the concentration of cross-linkages in rub-ber vulcanizates. Dis-azodicarboxylates containing two of the functional groups
-O-CO-X=X-CO-O- react quantitatively with rubber; the concentration of cross-linkages is determined by the molar



Howard I. Cramer

proportion of the dis-azo ester employed

In the present investigation elastic properties of azo cured rubber vulcanizates have been investigated as a function of the degree of cross-linking. The magnitude of the elastic modulus has been found to be in good agreement with theory in the case of vulcanizates containing about one mole per cent. of cross linkages. However the modulus varies less with degree of cross-linking than the direct proportionality predicted by theory. The stress-strain curve exhibited by azo cured rubber is generally similar in shape to that for sulfur-cured samples, although differences in certain details are indicated. P. J. Flory, N. Rabjohn, M. C. Shaffer, Goodyear.¹

Thermodynamics of Crystallization in High Polymers. IV. Melting Point Relationships. Through the application of statistical-thermodynamical methods to crystallization in high polymers, relation between the melting point, T_m, and polymer composition have been derived. Thus, for a copolymer containing a mole fraction X₁ of A units capable of crystallizing $1/T_{\rm m} - 1/T_{\rm m}^{\circ} = -(R/h_{\rm u}) \ln X_{\rm A}$

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where Tm° is the melting point for the pure polymer $(X_A = 1)$ and h_u is the heat of fusion per structural unit. This is analogous to the ideal solubility relation for simple liquids.

If the molecules are composed exclusively of A units but of limited length, the end groups being incapable of entering the crystal lattice, the dependence of melting point on chain length can be derived similarly. For chains uniformerly X units in length, for example,

 $1/T_m - 1/T_m^\circ = R/xh_u$ These equations offer a possible means for easily deducing the latent heat of fusion of the crystalline portion of a polymer

apart from the co-existing amorphous material. P. J. Flory.¹

Thermodynamics of Crystallization in High Polymers. V. Dependence of Melting Points of Polyesters and Polyamides on Molecular Weight and Composition. Melting points of decamethylene adipate polyesters of varying molecular weights and terminated with various end groups have been measured, using for this purpose a micro-melting point hot stage mounted on low-power microscope equipped with crossed Polaroids. Polymers having large end groups (benzoate, α-naphthoate, and cyclohexyl) possess the same melting points at the same molecular weight. The results are in accord with Equation 2 of the preceding abstract, from which a heat of fusion of about 3000 cal. per structural unit is computed. Smaller end groups (OH or COOH) lead to smaller melting point depressions, which seems to indicate that these terminal groups may occur within the crystallites.

Melting points for copolymers containing a fixed molar percentage of decamethylene adipate as the main ingredient generally are the same regardless of the other component. In further agreement with theory, the melting point-composition relation can be described by Equation 1. The heat of fusion deduced in this manner is about 3800 cal. per structural unit. If the second com-ponent also is capable of crystallizing, a cutectic composition and temperature is

observed.

Similar results have been obtained with decamethylene sebacate and with hexame-thylene sebacamide. Failure of certain copolymerized ingredients to give the expected depression in the melting point is attributed to isomorphism. H. R. Mighton, . Flory, R. D. Evans, Goodyear.1

Measurements of Stress Relaxation in High-Polymer Materials. A compact in-

Project sponsored by Office of Naval Research.

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strument has been developed for accurate measurement of stress relaxation. It consists of a jig having a leaf spring as a platform, above which is a cam-operated plunger which descends and compresses a sample placed on the leaf spring. Temperature-compensated strain gages mounted on the underside of the spring transmit minute deflections to an electrical recorder. The jig is located in a temperature-controlled oven above which is the recorder. Adequate space is allowed to temperature-condition a number of samples. The cam is operated manually by a lever outside the oven and on the front of the case which houses the entire unit.

Samples can be loaded rapidly, and the load adjusted through manipulation of the threaded plunger. The record of relaxation under the effectively constant deflection is continuous during the measuring time.

A stylus records the stress relaxation on a circular chart. The curve drawn is a logarithmic spiral. When this curve is replotted on semilog paper using time as abscissa and the ratio of load at time t to load at t_0 as ordinate, a straight line results. The relaxation obeys the formula $L = 1 - K \log t$ where t_0 and t are the

effective starting and subsequent times, and Lo and L are the corresponding loads. A is a constant characteristic of the material tested and can be used as a criterion. W. S. Macdonald and Al. Ushakoft, W. S. Macdonald Co., Cambridge, Mass.

Properties of Starch Pastes and Solu-tions and Their Molecular Interpreta-tion. Starch solutions and pastes exhibit peculiar properties which can be under-stood only through a thorough knowledge of the physical chemical behavior of the individual components of the starch grain and, in addition, of the morphological or-

ganization of the grain.

Crude amylose is a mixture of unbranched chain-molecules of various molebranched chain-molecules of various molecular weights. It is soluble in hot water; on cooling, its physical properties and its behavior toward enzymes and adsorbants change progressively. This "aging" is due to the formation of submicroscopic crystallites. Finally a flaky cryptocrystalline precipitate is formed. Fractionated preparations of amylose are less soluble and crystallize much more rapidly than crude amylose.

Amylopectin is a mixture of more or less branched polysaccharides of various molecular weights. Its solutions are much more stable than those of amylose. They finally stable than those of amprose. They imany crystallize, however, but in a particular manner; they solidify to a more or less turbid jelly. This phenomenon is to be attributed to the crystallization in "segments" and to the formation of entangled "fringe micellae." This kind of crystal formation also occurs during the growth formation also occurs during the growth of the starch grain. It accounts for its mechanical properties and its behavior in swelling. The viscosity of dilute starch pastes, the gel formation, and the liquefaction of concentrated starch pastes are dis-cussed. K. H. Meyer, University of Gen-

eva, Switzerland. Calculations of the Deviation of Poly mer Solutions from Raoult's Law. The general methods developed by the author in a previous paper² have been further developed and applied to actual calculation of the deviations from Raoult's solutions of high polymers. Calculations have been made of the deviations which would be shown by some idealized models of polymer solutions. These models consist of three-dimensional simple cubic lattices in which polymer chains occupy sequences of sites. Calulations have been made for various shapes of polymer chains—for ex-ample, single, double, and quadruple rods, spirals, and cubes.

It is noteworthy that the deviations predicted for the more compact of the above shapes are smaller than those given by the simple Flory³ - Huggins⁴ - Guggenheim⁵ theory in better agreement with experi-ment. Bruno H. Zimm, University of California, Berkeley, Calif.



C. W. Christensen

Average Square Length and Radius of Normal Parafin Hydrocarbon Molecules. Long-chain molecules can in general exist in many more or less coiled configurations because of the possibility of internal rotations about the connecting bonds so that it is necessary to treat the properties of such molecules on a statisti-cal basis. Two important parameters entering into physical theories are the average (square) length and radius (measured from the center of mass). Theoretical formulae for these two quantities which take into account the effect of the potential barriers hindering the internal rotations have been published previously.⁶ In the present paper these fomulae are applied to the normal paraffin hydrocarbons. The potential barrier for each rotation as established semi-quantitatively by statistical-thermo-dynamic calculations has a principal threefold component characteristic of the carbon-carbon single bond, and a smaller onefold component essentially a result of repulsions between non-bonded atoms. The threefold component is found to have no effect on the length or radius, but the onefold component increases these quantities by a factor of the order of magnitude of two over the values for free rotation and also gives rise to a negative temperature also gives rise to a negative temperature coefficient. W. J. Taylor, American Petro-leum Institute Research Project 44. Na-tional Bureau of Standards. Synthesis of Multichain Polymers and Investigation of Their Viscosities. An interesting class of non-linear condensation

polymers, which we have termed "multi-chain polymers," can be prepared by co-reacting a bifunctional compound, the functional groups of which are unlike, with a small proportion of a multifunctional reactant, the functional groups of which are alike and unable to react with one another. Such polymers, depending on the functionality of the multifunctional reactant,

may be highly branched, but are incapable of network formation.

Multichain polyamides synthesized from ε-aminocaprolactam using tetra- and octa-basic acids as multifunctional reactants have been prepared for quantitative investigation. The fact that these polymers are characteristically thermoplastic and soluble in the usual solvents affords further evi-dence that gelation is the manifestation of network formation; mere branching of the molecules is insufficient.

Solution and melt viscosities of these polyamides have been measured and compared with viscosities of the linear ε-capro-amides composed of one and two chains. Contrary to accepted opinion, the influence of branching on viscosities (both solution and melt) is quite small. When solution viscosities are compared at the same viscosity average molecular weights and the melt viscosities at the same weight average molecular weights, only the results for the octachain polyamides depart significantly from results for the linear polyamides; and

even in this case the departure is not large. J. R. Schaefgen and P. J. Flory, Goodyear. Ultrasonic Determination of Molecular Weight, Compressibility, and Ratio of Specific Heats for Some Silicone Fluids. Ultrasonic velocities in 14 linear polydimethyl-siloxanes have been measured at 30 and 50.7° C. The rate of change of velocity with temperature is normal, in contrast to the unusually flat viscosity-temperature relation.

By a recent method based on sound velocity the number average molecular weights of these liquids have been determined with an average accuracy of about 5%. The molecular weight is an explicit function

$$M = \frac{Bd}{v^{1/3} - A \cdot (\frac{n^2 - 1}{n^2 + 2})}$$

of density d, sound velocity v, refractive index n, and two empirical constants A and B. However the accuracy decreases for molecular weights above 10 or 15 thousand.

The adiabatic and isothermal compressi-bilities of these polydimethylsiloxanes, as computed from sound velocities, are un-usually high; the compressibilities of two partially phenylated silicone fluids are much lower. The ratio of specific heats, equal to the ratio of isothermal to adiabatic compressibility, decreases monotonically as the molecular weight increases. Such a result is expected because of the increasing complexity of the molecule.

Just as for the familiar case of molar refraction, the molar sound velocity v1/3-

may be calculated by summing the incre-ments for each atom in the molecule. The (previously unreported) sound velocity increment for silicon is here evaluated at 122, the average value from the first four polydimethylsiloxanes. A. Weissler, Naval Research Laboratory, Washington 20, D. C.

Statistical Thermodynamics of Sorption of Water Vapor by High Polymers. The statistical method of treating the sorption of vapors begun by Fowler and Guggenheim and extended by Cassie and by Hill is further generalized here to include variable heats of sorption in different layers. The general result obtained is N

$$\frac{N}{N_a} = \frac{\phi}{\phi} Z$$

where N is the number of moles sorbed, Ns, the number of sorption sites, Z is proportional to the relative vapor pressure, and ϕ is a function of Z. It is shown how this equation can reduce to a linear iso-

²J. Chem. Phys., 14, 164 (1946), ³Ibid., 10, 51 (1942), ⁴J. Phys. Chem., 46, 151 (1942), ⁵Proc. Roy. Soc., A 183, 203 (1944), ⁸J. Chem. Phys., 15, 412 (1947), ⁷K. S. Pitzer, Ibid., 8-711 (1940).

therm even with multilayer sorption and to various modifications of the BET equa-The equations so obtained will be illustrated with data for the sorption of water by various high polymers, including new results on the surption of water by elastic nylon, M. Dole, Northwestern Uni-Evanston, III.

Oxidative Stability of Cellulose Derivatives. I. Heat Stability of Ethylcellu-lose. The heat degradation of ethylcellulose at elevated temperatures (69 to 90° C.) has been shown to be an oxidation brought been shown to be an oxidation brought about by the oxygen of the air. The rate of oxidation, in pure oxygen, has been shown to follow a typical chain mechanism in which the rate of formation of peroxides is the controlling step. The loss of ethoxyl and reduction in viscosity has been shown to be due to the subsequent decomposition of the hydroperoxides formed.

The induction period of the reaction is dependent upon the presence or absence of chain reaction initiators such as peroxides and aldehydes, and the general rate of oxidation is independent of the degree of substitution and viscosity within the usual

commercial ranges.

The reaction can be inhibited or retarded by the introduction of a typical antioxidant such as the monobenzyl ether of hydro-quinone, substituted phenols, disphenylamine, and aromatic and aliphatic primary mercantans. The effectiveness of the inmercaptans. The effectiveness of the in-hibition is dependent upon the concentration and chemical nature of the antioxi-dant. L. F. McBurney, Hercules.

II. Ultraviolet Light Stability of Ethyl-The ultra-violet light stability of ethylcellul se has been shown to be a function of its ease of oxidation. The rate of ethylcellulose oxidation at 50° C. was deemyreninose oxidation at 50° C. was de-termined both in the dark and under ultra-violet irradiation. The ultra-violet light catalyzed the oxidation by reducing the induction period to zero and increasing the rate of oxidation manifold. The drop in viscosity, loss of ethoxyl, effect on color, and formation of peroxides and acidic groups upon increasing oxidation were compared for the ultra-violet catalyzed and dark reactions at equal oxygen absorptions Little difference was observed between the two reactions, leading to the conclusion that both proceed by essentially the same mechanism as elucidated in Part I for the oxidation of ethylcellulose at 90°

The ultra-violet catalyzed oxidation was subject to inhibition by the usual antioxidants. Therefore the use of antioxidants in commercial ethylcellulose formulations ex-posed to sunlight should reduce their tendency toward any degradation due to oxiation of the ethylcellulose. E. F. Evans and

L. F. McBurney, Hercules.

III. Heat Stability of Cellulose Acetate Cellul se acetate is intrinsically a stable material toward oxygen oxidation. At sufficiently elevated temperatures, however, does undergo oxidation. The rate of oxidation in pure oxygen was sufficiently rapid at 160° C. to enable the reaction to be followed easily. As a result of oxidative degradation, carbon monoxide and other volatile products were formed and had to be removed continuously to measure the rate of oxidation. The curves for the oxygen absorbed versus time showed induction periods which correlated roughly with a standard heat-stability test for cellulose acetate. Long induction periods were found to be associated with good stability.

Once oxidation was initiated, a rapid rate was quickly attained. Upon progressive oxidation, a yellow-orange color developed which obeyed Beer's law and was formed in direct proportion to the oxygen tosity of the cellulose acetate dropped in a manner which indicated

relation between the number of chain breaks and the amount of absorbed oxygen. Upon further oxidation, however, the rate of chain scission decreased sharply. Upon oxidation of secondary cellulose acetates, the per cent. of combined acetic acid in creased as the oxidation progressed and approached the fully substituted or triacetate value. An interpretation of these data as to the course of cellulose acetate oxidation is suggested.

Cellulose acetate cast into film from ace tone solution tenaciously retained a small amount of solvent which caused a small, but rapid, initial oxidation. Despite this difficulty it was shown that as little 0,001% free sulfuric acid present in cellulose acetate films acted deleter ously by reducing the retardation period and by catalyzing the oxidation. E. F. Evans and L. F.

McBurney.



Charles R. Haynes

The Division of Paint, Varnish, and Plastics Chemistry also held a sympo-sium with the Division of Chemical Education on "Recent Developments in Syn-Abstracts of some of thetic Plastics. these papers are given below:

Lactic Acid Derivatives as Plastici-

zers. Diglycol Bis-Carbonates of Lactic Esters. Twenty-three diglycol bis-carbonates of lactic esters were prepared by the action of the diglycol bis-chloroformate on lactic esters. These esters had molecular weights ranging from 366 to 627 and boiling points (1.0 mm.) ranging from 200 to

All the esters were compatible either polyvinyl chloride-acetate (95:5) or cellulose acetate, and about one-third of them were compatible with both. All were compatible with ethyl cellulose. strength, modulus at 100% elongation, ultimate elongation, and brittle point were determined on each of the plasticized vinyl compositions. Other data reported on the esters include vapor pressures, viscosities, viscosity index, water solubility, boiling water stability, and free acidity.

Since these esters were prepared in good yield from commercially available and relatively inexpensive materials and since several of them compared favorably with dioctyl phthalate as plasticizers for vinyl resins, they should be of considerable interest to the plastics industry. C. E. Relberg, M. B. Dixon, C. H. Fisher, Eastern Regional Research Laboratory, Philadel-Eastern

Lactic Acid Derivatives as Plasticizers. Esters of Polymeric Lactic Acids. A number of acyl derivatives of alkyl polylactates have been prepared and evalu-

ated as plasticizers for vinyl chloride polymers. Alkyl polylactates were made from methyl, ethyl, and butyl lactate by heating these lactates in the presence of a mineral acid catalyst and distilling the corresponding alcohol — i.e., methanol, ethanol, and butanol. The degree of polymerization was governed by the quantity of alcohol removed and the conditions of the experiment. Polymers of low molecular weight were easily obtained by heating the lactates at 100 to 175° C, and removing the alcohol under reduced pressure.

The polylactates were also prepared by the alcoholysis of methyl lactate with a higher alcohol and distillation of methanol from the reaction mixture. A ratio of approximately three moles of methyl lactate to one of higher alcohol gave polylactates of low molecular weight. The polylactates so obtained presumably were mixtures of methyl polylactate and the higher alkyl

polylactates.

A third method of preparing the alkyl polylactates, particularly useful for the preparations of polylactates of the higher alcohols, was the esterification of a mixture containing three or more moles of lactic acid, one mole of alcohol, and a mineral acid catalyst. Water was removed by carrying out the esterification in vacuum or by use of an entraining agent. The polylactates of β -butoxyethanol, n-octyl, and 2-ethylhexyl alcohol were prepared by this method.

The alkyl polylactates were acylated with one of the following: acetic anhydride, propionic anhydride, benzoyl chloride, lauroyl chloride, 2-ethylhexoyl chloride, and diglycol chloroformate. The products were mixcol chlorotormate. The products tures of esters of monomeric, dimeric, triwere not distilled, but were isolated as a mixture after washing and treating with activated charcoal. The resulting materials were almost colorless, high-boiling, viscous liquids.

esters were generally compatible with a 95% vinyl chloride-5% vinyl acetate copolymer and ethyl cellulose. However they were not generally compatible with cellulose acetate. E. M. Filachione, E. J. Costello, and C. H. Fisher, Eastern Re-gional Research Lab.

Synthetic Elastomers as Plasticizers for Condensation Polymers. I. Thermosetting Perbunan-Phenolic Compounds. Results are presented on the plasticization of phenolic resins by the use of several syn-thetic elastomers such as Perbunan (NS), polybutadiene, and S-polymers. The Perbunan (NS) polymers are a commercial class of butadiene-acrylonitrile copolymers stabilized with a non-toxic and non-staining antioxidant. The S-polymers are co-polymers that contain styrene. In the investigation about 50 thermosetting rub ber-resin compounds were made on a lab-oratory rubber mill. The tests carried out on most of the compounds included: 100% modulus, tensile strength, ultimate elongation, crescent tear, Shore durometer hardness, Rockwell hardness, heat of distortion, Izod impact, flexural strength, compressive strength, rupture compression, brittle temperature, specific gravity, weight loss, heat aging at 212° F. light aging, and volume increase in A.S.T.M. Reference Fuels No. and No. 2, A.S.T.M. Oil No. 3, and

Results indicate that up to about 50% resin these compounds are rubbery or leathery. As the resin content is increased above 50%, the compounds are no longer extensible and rubbery. The effect of the rubber is, however, still pronounced on the impact strength and brittle temperature. Perbunan-18 phenolic leather-like compounds were formulated that had a brittle temperature below -70° F. Some of the

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compounds were light yellow in color. The advantages obtained by using S-polymers in the Perbunan-phenolic blends are listed: (1) improved processing properties, (2) (1) improved processing properties, (2) improved oven-aging properties, (3) improved crescent tear values, and (4) improved color. R. G. Newberg and D. W. Young, Standard Oil Development Co., Elizabeth, N. J., and W. A. Fairclough, Enjay Co., Inc., New York, N. Y.

Anaylsis or Log Stiffness-temperature and Viscosity Characteristics of Pessin-Plasticizer Systems. A quantita-

Resin-Plasticizer Systems. A quantitative method of comparing resin-plasticizer systems in two important temperature regions is described. The characteristics in gions is described. The characteristics in the temperature region of application are evaluated from log stiffness-temperature curves and those in the processing tempera-ture region by parallel plate plastometer measurements. A simple and practical empirical equation has been developed which describes mathematically the inverted "S" shape log stiffness-temperature curves. The equation is characterized by four physically meaningful constants: the limiting stiffness at low and high temperatures, the temperature. Tm, at which the slope of the log stiffness-temperature curve has its maximum value, and the magnitude, S_m , of this maximum slope. This equation is shown to be applicable to a large variety of materials. The variation of T_m, with per cent plasticizer, which is approximately linear in the 15 to 50% concentration range, is shown to be a good measure of plasticizing efficiency. The magnitude of the slope, S_m, which is approximately independent of the plasticizer concentration in the 15 to 50% region, measures the temperature sensitivity of the resin-plasticizer system. The most useful quantity for comparing resinplasticizer system in the vicinity of processing temperature is the absolute viscosity ob-tainable by parallel plate plastometer tech-niques. It is shown that the log viscosityper cent. plasticizer curve is linear in the 15 to 50% concentration range. The slope of this curve is a measure of the high-temperature plasticizer efficiency. Thus two supplementary analyses permit quantitative comparison of various resin-plasticizer systems in the two important temperature re-

tens in the two important temperature regions—the general temperature region of application and the region of processing temperature. G. J. Dienes and F. D. Dexter, Bakelite Corp., New York.

Properties of Fillers in Vinyl Plastics.
The effect of loading nine well-known fillers into plasticized vinyl compounds has been shown. Loadings in to 80 reduces of been shown. Loadings up to 80 volumes of filler to 100 volumes of binder were used. In order to facilitate the dispersion of the filler, the 20- and 40-volume stocks were made by letting down the 80-volume stocks to the correct proportions. The results of the physical tests are shown on graphs for tensile strength, stiffness in flexure, hardness, hot tear strength, and resistance to abrasion.

The finer particle-size materials, as Micronex, P33, Silene, Kalvan, and Dixie clay, increased physical properties as the loading increases; whereas the coarser materials, as Atomite, Super Floss, Gartex, and whiting, merely act as diluents or extenders, and the properties decrease.

The subject of resistance to marring has been discussed. A method for determining

this property has been devised, using the Taber abrasion machine with knurled steel wheels for the purpose. It is thought that the particle size of the filler determines its resistance to marring; the finer particles show only slight marring; the coarser particles, marked scratch patterns.

It is believed that the greater adhesion of the finer particles to the binder prevents the tearing away of the filler and that the coarser particles allow vacuoles to be formed where the surface is scratched, thus leaving a series of holes that appear to the eye as a whitening of the surface. The same effect can be produced by sharply bending a sample loaded with a coarse filler. A whitening appears at the bend.

A tabulation has been given of the par-ticle size of the various fillers used. These data were furnished in most cases by the suppliers of the materials. R. L. Moore, Goodyear.

A Correlative Study of the Water Vapor Permeability of Saran Films. Despite the conspicuous position which Saran films occupy in any classification of transparent organic self-supporting, uncoated water va-por barriers, there has been little agreement among the many investigators concerning the absolute values of water vapor transmission. This state of affairs appears to be due chiefly to the diverse methods of attack employed and has resulted in such divergent values as to bring into question the reliability of published data.

In the present paper a comparative study of the methods and data of three rather different techniques is made: (a) standard cup tests (with modifications) which comprise a constant pressure evaluation; (b) a variable-pressure technique with new results on the modified General Foods gas transmission cell; and (c) a high-vacuum variable-pressure technique.

When all the factors which might in-

fluence the transmissions are examined, two are found to contribute most to the apparent discrepancies in reported values: (1) the difference in transfer rate due to the vapor pressure differential as exemplified by the constant pressure and the variable pressure extremes; and (2) the time factor involved in the determinations. The latter varies from two to more than 24 hours, and this variation among the techniques is extremely significant in view of the experimental results. Finally, the removal of volatile constituents from plastic films usually involved in variable-pressure techniques also contributes to the apparent

Reduction of the data to the same con-ditions where possible indicates that pub-lished results are actually closer together than is apparent merely from transmission values. The final difference is less than 10±1 which may be considered satisfactory where permeability constants in the range $P = 10^{-8}$ are involved. The remaining difference must be attributed to the two distinguishing steps in technique: (1) vacuum deplasticization and (2) pressure differen-

graphical analysis of water vapor transfer data obtained from a cup tests in-dicates that better correlation is made by using "equivalent" transmission (transmission calculated from $\Delta W/\Delta t$ where ΔW is the same, irrespective of time, vapor pressure, temperature, etc.) than by using short or long interval transmission. T. W. Sarge,

or long interval transmission. T. W. Sarge, Dow Chemical Co., Midland, Mich, Preparation and Properties of Alkylphenol-Acetylene Resins. Resins prepared by the catalytic reaction of *p*-alkylphenols with acetylene in the presence of an inert diluent at elevated temperature and pressure are brittle solids resembling, in some respects the oil solids resembling. in some respects, the oil-soluble alkyphenol aldehyde condensation products. The *p-tert*-butylphenol acetylene resin, known as Koresin, developed first in Germany and now made in this country, is one of the most effective tackifiers known for Buna S

In addition to duplicating the foreignmade material, several reaction variables were studied. For preparing the product containing a *p-tert*-butylphenol to acetylene mole ratio of 1:1 to 1:1.4 it was observed that:

(1) The reaction rate was unchanged by varying the zinc naphthenate catalyst con-centration from 8:1 to 4.2%; the other reaction variables were held constant. However, with a 2.1% concentration the rate was decreased considerably, and the tack value of the product was lower than the standard.

(2) A number of other zinc and cadmium carboxylic acid salts acted as catalysts to produce Koresin-like products.

(3) The reaction rate decreased with

decrease in total pressure.

(4) The best-quality Koresin was obtained by use of the purest grade of *p-tert*butylphenol.

Also p-tert-amylphenol and diisobutyl-Also perceivally phenol were reacted with acetylene to form products similar to Koresin, but of somewhat lower tack values and melting points.

The physical properties studied included solubility, compatibility, cloud point, melting point, molecular weight, stability, infrared absorption spectra, and X-ray pattern. Observations on the methods of applica-tion to synthetic rubbers and other possible uses are given. A discussion of the reaction mechanism and polymer structure is included, and the following formula is proposed.

A. O. Zoss, W. E. Hanford, C. E. Schild-knecht, General Aniline.

Allyl Esters of Phosphonic Acids. II. Allyl Esters of Phosphonic Acids. 11. Polymerization of Diallyl Benzenephosphonate. The allyl esters of certain arylphosphonic acids have been found upon heating with benzoyl peroxide catalyst to undergo self-polymerization as well as copolymerization with other polymerizable monomers to produce infusible, insoluble, logal transportation and flame resistant. hard, transparent, and flame-resistant res

In view of the fact that recent interest has been evidenced in the low-pressure type of thermosetting resins, it was considered probable that technically interesting resins of this type might be obtained by the polymerization and copolymerization of these allyl phosphonates. Accordingly the polymerization characteristics of one member of this series, diallyl benzenephospho-

nate, were studied more extensively.

When diallyl benzenephosphonate is heated in the presence of benzoyl peroxide catalyst, it becomes first a viscous liquid, then a gel, and finally a hard, transparent resin. The time required depends on the catalyst concentration, size of the specimen, and conditions of heating. In general, a resin may be cured in 2.5 to 18 hours. Among properties of interest for the resin are (a) high refractive index of 1.573, (b) heat distortion temperature of 217° F., and (c) self-extinguishing property when set afire.

Upon copolymerization with methyl methacrylate, diallyl benzenephosphonate forms thermosetting infusible and insoluble resins whose refractive indices vary with the copolymer composition. A fairly trans-parent glass laminate was obtained when the laminate was prepared by using the copolymer having a refractive index matching that of the glass fabric.

Diallyl benzenephosphonate was also found to be capable of copolymerization

S Present address, M. W. Kellogg Co., New York.

with vinvl acetate, diallyl esters of organic acids, and the unsaturated polyesters.

All the copolymers are hard, strong, and transparent resins when cast in solid pieces. They may be used as laminating resins for low-pressure laminates. Copolymers containing 10 to 30% diallyl benzenephosphonate possess self-extinguishing characteris-

ties when ignited.

Of special importance is the copolymer with unsaturated polyesters, since most of the new so-called 100% active thermosetting contact pressure resins are of this type. Glass fabric laminates using a copolymer of the allyl phosphonate with unsaturated p dyesters have been made successfully with a curing cycle of 30 minutes. This suggests their use in continuous laminating machines employing such contact pressure resins.

It is believed that the diallyl benzene phosphonate may find application as a modifier for the unsaturated polyester resins. The most remarkable attribute is that it will improve the flame resistance of the resin. A. D. F. Toy and L. V. Brown, resin. A. D. F. Toy and I Victor, Chicago Heights, Ill.

Emulsion Polymerization of Acrylic Esters and Certain Other Vinyl Monomers. The previously reported study of emulsion polymerization of acrylic esters was extended to include (a) use of additional emulsifying agents, (b) preparation of high-solids latices by direct polymerization, (c) preparation of 2-chloroallyl alcohol copolymers in high- and low-solids latices, (d) polymerization and copolymerization of the higher alkyl acrylates, (e) of various organic peroxides as poly merization initiators, and (f) extension of the emulsifying systems used with acrylates to the polymerization of other monomers

It was demonstrated that many types of latex containing various acrylic polymers and copolymers can be prepared and that the emulsifying system has a profound effect on their properties. Emulsions containing 60% resin were prepared satisfactorily. The emulsifying systems and conditions developed for acrylic esters, which differ in several respects from those recommended for dienes, are suitable for the polymerization of certain other vinyl-type monomers. W. C. Mast and C. H. Fisher. Eastern Regional Research Lab.

Solubility of Polystyrene in Hydrocarbons. The solubility of two samples of commercial low-molecular-weight polystyrene has been measured in n-decane and n-octadecane and in mixtures with toluene between 20 and 110 degrees. The resins were soluble in the alkanes in a limited range; n-decane was the best solvent. Addition of about 30% toluene has little effect, but larger amounts of toluene with the alkanes greatly increase the solubility. Above toluene with n-octadecane, the more highly polymerized resin is soluble at all concentrations at room temperatures. Solubility has been plotted at 20, 50, 80, and 110 degrees for the two resins indecanetoluene and octadecane-toluene mixtures.

These results are in general agreement with the expected behavior for polymersolvent systems except that the critical concentration occurs in several cases at above 50% resin concentration. The behavior is believed to be characteristic of resin-plasticizer systems. Exudation of plasticizer in a relatively pure form is consistent with the less readily miscible systems.

The Division of Industrial and Engineering Chemistry held a joint symposium with the Division of Paint, Varnish, and Plastics Chemistry on the subject of "Chemical Engineering in the Plastics Industry." Abstracts of several of these Industry. papers follow:

Introductory Remarks on Chemical Engineering in the Plastics Industry.

This symposium is frankly somewhat of a pioneering experiment. The plastics inpioneering experiment. The plastics in-dustry in this country is relatively new-The earliest synthetic plastics in the United States were the phenolaldehyde resins, which started with Baekeland's original experiments in 1909, but did not grow to a large volume of business until a number Manufacture of of years later. plastics is much newer and the most important synthetic members of the groupstyrene and vinyl chloride-only began to be important articles of manufacture this country about a decade ago. organic and physical sides of the plastic industry have been quite thoroughly covered in recent years; much less infor-mation exists on the developments in chemical engineering.

The processing of plastics is a branch of chemical engineering, in so far as it involves handling chemical products under elevated temperatures and at high pres-In fact the plastics industry unique in that the finished products are always materials of extremely high viscosity, and it is in handling products of such viscosity that most of the chemical engineering problems are met. the papers on this symposium are specifiinvolved with this phase of the pro-Two other papers compare German developments with our own practices and are particularly interesting in contrasting methods of handling which were developed abroad compared to those which we have

developed.

We hope that this symposium will lead to other and more exhaustive treatments of the subject. There is really very little information in the literature which the practical chemical engineer can utilize in the design of emipment where plastic flow is concerned. The topic is a worthwhile one for a more exhaustive study by some of our chemical engineering schools. Carswell, Commercial Solvents Corp., Terre Haute, Ind.

Plastic Extrusion Equipment and Technique as Applied to Monofilaments. Plastic monofilaments are made by extruding plastics through a multiple-orwhich forms the materials into small diameter rods, which are stretched and annealed to produce finished monofilaments. Extrusion, cooling, stretching, and annealing are usually carried out in one continuous operation. Plastic extruders made by various manufacturers differ in special features, but all are essentially screws operating in a close-fitting cylinder with a suitable die fitted adjacent thereto for shaping the extruded product. machine size, good die and head design, and control of the required extrusion temperatures are important factors for satisfactory monofilament extrusion.

Processing techniques and conditions have significant effects on the physical properties of the finished monofilaments. Data show the effects of processing variables on tensile strength, knot strength, ultimate elongation, and per cent. shrinkage at elevated temperatures of monofilaments made from a vinyl chloride-vinyl acetate copolymer and polyethylene resins. studies show that the tensile strength of the monofilament increases as the per cent. stretch used to make the monofilament increases, and further increases with molecular weight of the resins. Knot strength is lower in pounds per square inch than straight tensile strength. Ultimate elongation increases as the per cent. stretching decreases. Annealed monofilaments shrink elevated temperatures than un-

Persons engaged in the extrusion and orientation of circular monofilaments often find it necessary to make calculations of

length, extrusion rate, weight, diameters, etc., on their product. Four graphs which illustrate the length, weight, and diameter relations of circular monofilaments are presented. The equations on which these are based are also included. W. F. Hemperly and G. G. Himmler, Bakelite.

Rheological Problems in the Processing of Plastics. In the first part of this paper the various deformation mechanisms of high-polymeric substances are discussed in a general manner. Three different types of deformations are possible : ordinary elastic, highly elastic, and viscous deformation, The various constants which characterize mechanisms are: a set of elastic moduli, a set or spectrum of relaxation times, and a viscosity coefficient. If a variable force is acting on the material, the dependence of the elastic moduli and of the viscosity as a function of the frequency must be taken into account. relation between the viscosity coefficient molecular properties is considered. with particular reference to Eyring's the coefficient is discussed.

In the special ory, and the effect of orientation and breakage of "bonds" on the viscosity

methods to measure the flow properties of plastic systems, covering a wide consistency range, are described. The problem of obtaining material constants independent of instruments used is given particular attention. Because the viscosity coefficient of most high-polymeric systems is not only a function of temperature, but also a function of time, shearing force (or rate of shear) and previous history, it is important to obtain a complete evaluation of the flow properties, to establish a satisfactory correlation between them and the

processing behavior.

In the final section of the paper it is shown how the flow properties affectand to some extent determine—the pro-cessing behavior of plastic systems. Be-cause of the lack of extensive quantitative data it only is possible to give a qualitative discussion. The following processes are considered in some detail: coating of impervious and pervious surfaces milling and calendering, extrusion, and molding. H. K. Nason and R. Buchdahl, Monsanto Chemical Co., Dayton, O. Continuous Polymerization in Ger-

many. Three common thermoplastic materials are produced by I. G. Farben continuous polymerization methods. These include the mass polymerization of styrene and vinyl acetate, and the emulsion poly-merization of vinyl chloride. Information concerning these processes, which has been scattered through various OTS publications, is summarized and discussed with emphasis on the equipment and engineering The three processes are similar. features. general the equipment has the form of tall slender autoclaves to which monomer is added at the top and polymerized product drawn from the bottom. The increase in specific gravity, as polymer is formed. is utilized to obtain a separation of poly-mer from monomer. Material flows and heat removal are controlled to avoid turbulence. Each installation is designed to fit the characteristics of the material being polymerized.

Styrene is polymerized without a catalyst in aluminum equipment, and the polymerized product is extruded as a narrow band, cooled, and cut into a granular product. Vinyl acetate is handled in a manner similar to styrene with the addition of an organic peroxide catalyst. This process can be used for only a limited range of molecular weights of polyvinyl acetate; the process cannot be controlled to obtain low molecular weights, and the higher molecular weights do not have sufficient

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flow or mobility to be processed. Vinyl chloride is polymerized at 5 to 6 atmospheres in glass enameled autoclaves. The aqueous component containing catalyst and emulsifier is charged continuously along with the vinyl chloride. The emulsion is formed and the polymerization carried out as the stream flows through the autoclave. The solid product is isolated by one of three methods: coagulation, drum drying, or spray drying. R. D. Dunlop and F. E. Reese, Monsanto, Springfield, Mass.

Notes on the Stimulation of Plastics

Technology by German Disclosures.
Two years ago teams of investigators irom Ordnance and Quartermaster departments reviewed German operations in the plastics field. While few of these were entirely new to American industry, their disclosure helped expedite the utilization of various materials and methods in the

American public interest.

In the vinyl field, resins suitable for pastes are now being offered by American manufacturers, and a French firm, which has installed German processes, is offering a smooth extruding, unplasticized polyvinyl chloride. Because of its higher molecular weight and, therefore, higher effective softening temperatures, there is possibility of following the German applications in storage batteries. Vinyl ethers are on the American market, and there is some progress toward the manufacture of the low-cost phenyl sulfonates of hydrocarbons for plasticizer. Incidentally the sulfonchlorides, which are intermediate in this process, were the subject of an old American patent now controlled by a large American chemical company. Polyvinyl pyrrolidone for blood extension is under extensive study.

In the German cellulose acetate industry all companies, regardless of the methods for the production of acetate, used Wacker vapor-phase catalytic cracking for the conversion of glacial acetic acid to ketone. This seems to be pointing the way for American industry on account of the economy of reconversion at the producing plant. Although the American soap supply is much better than the German, so that little extension is necessary, carboxymethylcellulose has practically supplanted the other

cellulosics as a water-soluble thickener. In the polyamid field, caprolactam is on the market, and some of the new molding powders, less crystalline in character, show a good degree of transparency. The conversion of tetrahydrofurane to hexamethylene diamine through 1.4-dichlorobutane and tetramethylene dicyanide has received much recent publicity. In American practice there is the additional quirk of making the tetrahydrofurane from furfural. Polyamids are now being offered in sheet form, and grades are available which can be extruded or cast from solvent.

In the rubber field, the chain straightener

In the rubber field, the chain straightener disopropyl dixanthogen is being offered as an article of commerce; "fast" polymerization by the use of small amounts of reducing agents is being applied in several measurate polymerization fields; Koresin, the isobutyl phenol-acetylene condensate, is being offered to the American market; and a non-discoloring diazo foaming agent has appeared.

The impact of various mechanical processing methods has not been so considerable. In the case of oriented polystyrene sheet, American manufacturers feel that their methods are equal in quality and higher in production than the German Styroflex. Although styrene and thin vinyl chloride sheet machines have been exhibited at Edgewood Arsenal and elsewhere, thin polyvinyl chloride unplasticized, has not yet made indentation on the market. On the other hand the tape method of re-

cording and the magnetic ferric oxides used for it are already widely applied and are competing vigorously with the wire recording methods.

Two American firms are offering isocyanates, and the application to foams in airplane structures is well along into experimental stages. These combinations of alkyds and isocyanates can be poured, after which they foam, adhere strongly, and cure to infusibility. Substantial advances in control and mechanical properties have been made over the German practice. J. M. DeBell and H. M. Richardson. DeBell & Richardson, Inc., Springfield, Mass.

The program of the Division of Organic Chemistry included many papers of interest to the rubber and plastics chemist.

Abstracts of a few of these papers follow: Effects of Inhibiters on the Thermal Polymerization of Styrene. Foord" and Goldfinger. Skeist, and Mark¹0 have shown the inhibition period of styrene polymerization by benzoquinone is directly proportional to the initial concentration of benzoquinone. It was assumed that each quinone molecule terminates either one or two polymer chains, and the activation energy for chain initiation was calculated. However in the thermal polymerization of styrene as 100° our calculations show that 16.2 quinone molecules were consumed per polymer molecule that would have been formed in the absence of quinone. Kinetic considerations show quinone radicals continue kinetic chains either through copolymerization or transfer Benzoquinone cannot be used to determine the rate of thermal initiation of chains in styrene.

mal initiation of chains in styrene.

Since it is desirable to be able to determine the rate of thermal initiation of chains by use of an inhibiter, each molecule of which would terminate one chain, other inhibiters were investigated. The stable radical triphenylmethyl would apparently have the best chance of terminating chains without starting any. The inhibition period increases with increasing initial concentration of hexaphenylethane. However larger concentrations of ethane are rela-tively less effective than small concentra-tions; the triphenylmethyl reacts in ways other than by terminating a radical chain. At 100° as many as 72 molecules of hexaphenylethane react for each molecule of polymer that would have been formed in its absence. Hence, since triphenylmethyl starts chains, we conclude almost any free radical may start or terminate a styrene chain, and the difference between catalysts and inhibiters is quantitative rather than qualitative. F. R. Mayo and R. A. Gregg, United States Rubber Co., Passaic, N. J.

The Copolymerization of Chloroethy-

The Copolymerization of Chloroethylenes with Other Monomers. Monomer reactivity ratios have been determined for the following systems: vinyl chloride with styrene; tetrachloroethylene with styrene, vinyl acetate, and acrylonitrile; and vinylidene chloride with vinyl acetate and diethyl fumarate. The data re correlated with other available data to give the following relative reactivities of six chloroethylenes: vinylidene chloride, > vinyl chloride, > trichloroethylene, > trans-dichloroethylene, > trans-dichloroethylene. This reactivity series can be accounted for qualitatively by a consideration of steric effects and the stabilities of the resulting radicals. K. W. Doak, U. S. Rubber, Passaic.

Steric Hindrance in the Copolymerization of Ortho-Substituted 2-Methylstyrenes. 2-methylstyrenes possess an advan-

tage over styrenes in that they do not polymerize readily with peroxide catalysts and hence can be stored and handled without loss. On the other hand they copolymerize normally, and the copolymers appear to have similar properties to the corresponding styrene polymers.

In investigating the copolymerization behavior of a series of substituted a-methylstyrenes we have found that ortho substituents sterically hinder the process and prevent formation of the expected coplymers. Molecular models show that even small sized groups prevent the full rotation of the isopropenyl group about the bond connecting it to the aromatic nucleus, and force the benzene rings to take up fixed positions along the poylmer chain like pennies strung on a wire through a hole near their centers. Even a fluorine atom, which is nearly small enough, and a methoxyl group, which may swing out of the way, prevent polymerization of the isopropenyl group.

penyl group.

In the thiophene series the angles between ortho substituents are greater than in the benzene series (72° in thiophene, 60° in benzene). This permits sufficient clearance so that even chlorine atoms do not inhibit polymerization of isopropenyl groups ortho to them.

The preparation and polymerization of a number of new substituted vinyl benzenes and vinyl thiophenes will be described.

G. B. Bachman, Purdue University, Laiayette, Ind., R. W. Finholt, Union College, and L. V. Heisey, Purdue.

Flextender 3A

FLEXTENDER 3A, a new rubber substitute and processing aid for use in natural and synthetic rubbers and vinyl copolymer resins, has been announced by Amecco Chemicals, Inc., 60 E. 42nd St. New York 17, N. Y. The material is a vulcanized petroleum oil derivative having a tough, rubbery consistency. It is compatible with natural rubber, nitrile rubbers, butadiene-stytene copolymers, neoprene, and vinyl copolymers. The new product is relatively low in cost and, unlike most extenders, imparts desirable properties to the rubber stock without abnormal sacrifice of the physical properties. It imparts tack to the uncured stock which disappears upon curing, and it exhibits excellent aging characteristics, according to the manufacturer. Flextender 3A is a dry material, readily handled in a Banbury or an open mill and is suitable for use in extruded stocks, flooring compounds, shoe soling compositions, and molded specialties.

New Navy Specifications

THREE new navy specifications have appeared since our previous listing in the June issue. Members of the rubber industry desiring copies of these specifications can obtain them upon request, giving title, number, and date, from the Navy Department, Bureau of Supplies and Accounts, Washington 25, D. C.

Federal Spec. ZZ-H-496a—Hose; Pneumatic, Braided, dated 24 April 1947 (8 pages). BuShips Spec. 52C15 (Ships)—Cement: For Attachment of Synthetic Rubber to Metal, dated 15 Iune 1947 (14 pages, including photographs). BuShips Spec. 33H12 (Ships)—Hose, Vacuum, dated 15 July 1947 (6 pages).

J. Chem. Soc., 48 (1940).
 J. Phys. Chem., 47, 578 (1943).
 Work done at Purdue University.

Course in Silicon Colloids

THE establishment of a course in the colloid chemistry of silicon at the Massachusetts Institute of Technology, Cambridge, Mass., was recently announced The new course, which will begin this fall under the direction of Ernst A. Hauser, associate professor of chemical engineering, will be a survey of the chemical and physical properties of substances containing silicon as their basic constituent in relation to their molecular structures. The impor-tance of this new branch of colloid chemistry to science and industry will be explained by offering examples taken from such fields as the rubber, plastics, ceramics, glass, paper manufacturing, and other in-

Chemical Industries Exposition

POSTWAR progress in the chemically controlled industries will be reflected in the exhibits at the Twenty-first Exposition of Chemical Industries at Grand Central Palace, New York, N. Y., on December 1 to 6. Advance indications show a marked trend toward the development of materials and units of all types designed to meet extremely difficult operating condi-tions, especially high pressures and temeratures and powerful corrosive agents-The exposition will be one of the largest of its kind ever held, with an unusual variety of displays including industrial chemicals, chemical products, industrial materials, and supplies of many kinds, in addition to a wide range of process equip-

In the equipment field there will be exhibits showing the use of stainless steel in an ever-wider range of processing units. including tanks, filters, coolers, evaporators, driers, pumps, valves, pipe fittings, kettles, etc. Lead-lined processing equip-ment will also be featured. High-temperature sintered refractories for use as cataly-tic carriers will be shown, as will be a new infra-red gas analyzer. In the field of infra-red gas analyzer. In the field of measurement and control there will a display of electronic-type instruments for measuring flow, pressure, temperature, pH,

Connecticut Group Elects

THE balloting for officers of the Connecticut Rubber Group for 1947-1948, on the slate of candidates announced and approved at the Group's last meeting on May 9, was carried out by mail during the summer. Final results of the ballot-ing were recently announced, and the new officers are as follows: chairman, Raymond H. Dudley, of Whitney Blake Co., who automatically succeeded to the chairmanship from his previous position of vice chairman; vice chairman, Stuart M. Boyd, United States Rubber Co., who defeated George D'Olier, of Raybestos Division, Raybestos-Manhattan, Inc.; secretary Donald Spengler, of Sponge Rubber Products of R. T. Vanderbilt Co.; treasurer, Carl Larson, of Whitney Blake Co., who defeated Edward J. Geise, of J. M. Huber Corp.; and directors, Edmund J. Butler, of General Electric Co., and Alfred J. Jensieved E. Larson, Deed A. St. Corp.; and Company of Control of Con nings, of E. I. du Pont de Nemours & Co., Inc., who defeated Dean J. Bennett, of Seamless Rubber Co., and George Sprague, of Spong: Rubber Products.

Pacific Chemical Exposition and Conference

•HE 1947 Pacific Chemical Exposition, sponsored by the California Section of the American Chemical Society, will be held at the Civic Auditorium, San Fran-cisco, Calif., October 21 to 25. The exposition will comprise exhibits by some 125 companies, including Amecco Chemicals, Inc., American Cyanamid Co., American Hard Rubber Co., Armour & Co., Shell Oil Co., Inc., and Stauffer Chemical Co. In addition there will be several special exhibits by government agencies and a continuous program of industrial motion pictures, including "Building of a Tire" nd "Bouncing Molecules."

The Pacific Industrial Conferences will

be held concurrently with the exposition. Twelve organizations are cooperating in the conferences, including the Northern California Rubber Group and The Los Angeles Rubber Group, Inc., which are

Angeles Rubber Group, Inc., which are presenting a joint rubber program on October 23 and 24 in the Auditorium. The rubber program will be divided into three sessions. The first, on October 23 at 1:00 p.m., will consist of introductory remarks by the chairman, L. H. Dimpfl, of California Research Corp.; Dimpfl, of California Research Corp.; motion pictures and a commentary on rubber compounding, by Leonard Boller, of Technical Coatings, Inc.; papers on "GR-S" by D. C. Maddy, of Harwick Standard Chemical Co., "Neoprene" by Herman Jordan, of E. I. du Pont de Nemours & Co., Inc., "Hycar" by Ray Bitter, of B. F. Goodrich Chemical Co., and "Thiokol" by Walter E. Boswell, of Thiokol Corp.; and a paper on "Perbunan and Butyl" and a showing of the film, "Bouncing Molecules," by E. N. Cunningham and R. M. Howlett, of Enjay Co.

ningham and R. M. Howlett, of Enjay Co.
The second session, on October 23 at 6:00 p.m., will comprise a dinner at the Hotel Witcomb; a paper on "Molecular Structure and Mechanical Properties of Polymers" by Herman F. Mark, of Polytechnic Institute of Brooklyn; and a panel discussion of compounding and floor ques-tions. Panel members will be Ross Morris, of Mare Island Rubber Laboratory, Mr. Boller, E. B. Reinbold, of Pacific Rubber & Tire Mfg. Co., Don Good, of American Rubber Co., Russell Kettering, of Oliver Tire & Rubber Co., John Liljigren, of Pioneer Rubber Mills, and George Petelin, of Goodyear Tire & Rubber Co.

The concluding rubber session will be held on October 24 at 1:00 p.m. Following an introductory address by Mr. Dimpil, four papers will be presented: "Carbon Black and Other Compounding Ingredients," by W. R. Snyder, R. T. Vanderbilt Co., Inc.; "Foam Rubber, Hard Rubber, and Other Specialties," Ralph T. ber, and Other Specialties," Ralph T Hickcox, Goodyear; "Mechanism of Pig ment Reinforcement of Rubber," by L. H. Cohan, Witco Chemical Co.; and "Solubility of Hydrocarbon Resins and Their Behavior in Rubber Compounds," by P. O. Powers, Battelle Memorial Institute.

Hydroquinone Derivatives

NUMBER of hydroquinone deriva-A tives until recently available only in laboratory amounts are now available in commercial quantities from Tennessee Eastman Corp., Kingsport, Tenn. Hydro-quinone is well known as an antioxidant and stabilizing agent for preventing de-terioration of fats, oils, and resin mono-

mers, but is handicapped by its low oil solubility and high water solubility. To overcome these restrictions Tennessee Eastman has produced two simple derivatives: hydroquinone mono methyl ether, and 2,5-ditertiary butyl hydroquinone. Both of these derivatives are considerably more oil soluble and less water soluble than hydroquinone and show less tendency to dis-

The hydroquinone mono methyl ether i currently in use as a stabilizing agent in several textile lubricating oil formulae. Because of the stability of the ether groups, the compound is a promising raw material for organic syntheses and has many pos-sibilities in the fields of drugs, cosmetics, and dyes. The 2,5-ditertiary butyl hydroquinone has been found suitable for use as a preservative in both synthetic and natural rubber compositions, in addition to its use as an antioxidant for vegetable fats and oils. It is a good polymerization in-hibiter for styrene and other resin monomers. Being non-staining and non-discoloring, it is particularly useful for stabilizing latices and white rubber stocks. According to the company, this chemical is the first new non-staining antioxidant for rubber that has appeared in several years.

hydroquinone derivatives offered by the company include hydro-quinone dimethyl ether, toluhydroquinone, hydroquinone diethyl ether, hydroquinone di-n-butyl ether, hydroquinone mono ethyl ether, hydroquinone mono-n-butyl ether, and hydroquinone di-(beta-hydroxyethyl)

New Bloom Inhibiter

NATAC, a new bloom inhibiter which has wide application in natural rubber and mixtures of natural rubber and GR-S, has been developed by J. M. Huber Corp., 342 Madison Ave., New York 17. N. Y. Natac is a modified resin acid which has inherent tack and is neutral with thiazole acceleration in natural rubber. The use of two to four parts of Natac per 100 parts rubber hydrocarbon will retard fatty acid and sulfur blooms and impart a lasting tacky surface to products in which it is compounded, the manufac-turer claims. Tire coat and friction stocks, tire repair materials, laminated mechanical parts, footwear friction, gum parts, and similar rubber stocks may be worked longer with Natac because of the reduction in blooming tendencies arising from cold weather, lay-over, rapid chilling, etc.

The material may be safely added to standard compositions or used in place of other softeners without affecting the physical properties of the cured stocks. Natac is a solid having a specific gravity of 1.082. It has a ball and ring melting point of 145-155° F., shatters readily at room temperature, and requires no previous melting before adding to the batch.

Acid-Resistant Neoprene Paint

AN ACID-RESISTANT neoprene paint for the protection of surfaces exposed to fats, oils, greases, or corrosive chemical liquids, solids, or fumes has been developed by Union Bay State Chemical Co. Inc., 50 Harvard St., Cambridge, Mass. The paint is a solution of neoprene in an aromatic solvent, with the addition of other materials to yield a chemically resistant coating. are aro inated 1 aliphati turpenti The brush a

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> to sul 253/4¢ 1947. bution, merce. over-p would the ex long t It wa chased 1947. than 1 centag refunc over-t subscr amout to ov the b in exe In serve in ac

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T Japa disse for now

Ser tion proc

synt com coating.

turpentine.

Miscible solvents for the paint

are aromatics, ketones, esters, and chlor-inated hydrocarbons, and thinners include

aliphatic hydrocarbons, mineral spirits, and

The paint may be flowed from a full brush and will adhere well to wood, metal, and other smooth surfaces, it is claimed.

A surface free from gaps, ridges, and pin-

holes will prevent any chemical from pen-

notes with prevent any cremical norm per errating beneath the paint and causing lo-calized damage which may spread to the film. The paint may also be sprayed if properly thinned with toluol or similar materials. The paint yields an odorless,

translucent, amber-colored, rubber-like film

which resists abrasive action and will not chip or crack. The film requires no oxi-

dation period and dries completely in sev-

N SETTING forth terms for the sale I'm SETTING form consistency of 150,000 long tons of natural rubber

subscriber companies at a price of 4ϕ per pound, a letter dated June 10.

1947, from the Office of Materials Distri-bution, United States Department of Com-

merce, stated that those subscribers who

over-purchased the amounts agreed upon would be issued a proportional refund to the extent that sales in excess of 150,000 long tons were made at the 25½¢ price. It was stated that if all subscribers pur-

chased the agreed amounts before July 15,

1947, all companies which purchased more than their agreed amounts, plus the percentage contingency, would obtain a full refund of the price differential on such over-purchases. On the other hand, if all

subscribers did not purchase their agreed amounts before July 15, 1947, the refund to over-purchasers would be prorated on

the basis of the total sales to subscribers in excess of 150,000 long tons. In order that the Office of Rubber Re-

serve may effect appropriate adjustments in accordance with this plan, all com-panies are being requested to furnish in-formation on the extent of their purchases

under their quota. Upon receipt of such in-

formation, Rubber Reserve will determine the amount of the refund or adjustment, if any, to which each company is entitled. Although non-subscriber companies are not

entitled to a refund or price adjustment,

Rubber Reserve has stated that it may be

in a position to make certain refunds or

adjustments to such companies, and they

are being requested to submit similar in-fermation on the extent of their purchases

ECHNICAL data on the manufacture **T** ECHNICAL data on the manufacture of synthetic rubber by seven firms in Japan and Korea are contained in a military intelligence report released for public dissemination by the Supreme Commander

for the Allied Powers in Japan and are now on sale by the Office of Technical Services. The report gives some indication of the volume of production and the processes used in the Japanese and Korean

The report deals with the following companies: Kanegafuchi Industrial Chemi-cal Co., Ltd.; Mitsubishi Chemical Indus-(Continued on page 93)

Synthetic Rubber in Japan

synthetic rubber industries.

of 253/4¢ rubber.

and Korea

Rubber Reserve Price Refunds

vision of Rubber Reserve within six months after the experimental polymer was produced. Subsequent production runs

are made if sufficient requests are received.

are made it suincient requests are received.

Correction:—Information on polymer X-354 GR-S published in our February, 1947, issue, page 676, stated under the heading of Special Characteristics, "Higher Mooney variation of X-353 GR-S is expected to produce wear in tires." This should have read "is expected to produce better wear in tires."

In our September issue page 793 X-402.

In our September issue, page 793, X-402-SP-GR-S, X-403-SP-GR-S, and X-404-SP-GR-S, were incorrectly listed as latices. These are bulk polymers.

Special Characteristics
The mixed emulsification improves tensile strength, particularly in mineral pigment stocks, and tack while retaining the excellent processability of GR-S-60-type GR-S polymers which are made by cross-linking or controlling the gel type and content. Reported to lack discoloration and staining tendencies when compounded and exposed to sunlight. May possibly be used asentire polymer or in blends with other GR-S polymers or natural rubber for mechanical goods and footwear applications. Should also be of interest as a processing aid for tire compounding in blends of five to 25 parts of the polymer.

High butadiene polymers have very low brittle point and are of great interest in end-products to be used under low-temperature service conditions. However processing and physical properties are not so good as those of Standard GR-S, and allowances must be made at this time for such properties to attain the excellent low-temperature properties. X-406-SP will be used for experimental tires.

Similar to GR-S-10AC,

Lyman Bill, Randolph Brown, all at 386 Fourth Ave., New York 16, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1% or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the mames of the owners, stockholders, and security holders are stockholders and security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by Fin.

B. P. ETTIM WILSON BOSON BO

SPECIAL CHARACTERISTICS

Additional Experimental GR-S and GR-S Latices

Manufacturing Date of Plant Authorization Polymer Description

8/28/47

8/11/47

8/21/47

NOT POLYMER DESCRIPTION
Similar to X-344 except
that the latex was emulsified by a mixture of rosin
and fatty acid soaps and
stabilized with UBUB.
Compounded Mooney viscosity range to be 125145.

A 95.5 butadiene-styrene monomer charge ratio GR-S with rosin soap emulsification, and a Mooney viscosity range of 60 to 70. Stabilized with 1.25 parts BLE.

Batchwise GR-S-10.AC at a slightly lower conversion (alum coagulation and rosin soap emulsification).

ADDITIONS to the list of experimen-tices available for distribution to rubber

goods manufacturers together with certain reauthorizations of previously listed polymers from the Office of Rubber Reserve, RFC under the conditions outlined in our

November, 1945 issue, page 237, have been received and listed in the table below.

Normally, experimental polymers are produced only at the request of the consumers, with 20 bales of the original run

set aside for distribution to other interested

companies for their evaluation. Such rub-

ber is available in quantities of one bale

to two bales upon request to the sales di-

U. S. Rubber, Naugatuck

U. S. Rubber, Naugatuck

Goodyear.

Torrance

Statement of India RUBBER WORLD

Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946, of India RUBBER WORLD, published monthly at Orange, Conn., for October 1, 1947.

State of New York State and County of New York State and County aforesaid personally appeared B. Brittan Wilson, who, having been duly sworn according to law, deposes and says that he is the Business Manager of India RUBBER WORLD and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation) etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, and July 2, 1946, (Section 537, Postal Laws and Regulations) printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: publisher, Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N. Y.; editor, Robert G. Seaman, 386 Fourth Ave., New York 16, N. Y.; business manager, B. Brittain Wilson, 386 Fourth Ave., New York 16, N. Y.; 2. That the owner is: Bill Brothers Publishing Corp., Caroline L. Bill, Raymond Bill, Edward

State of New York County of New York ss.

X-NUMBER DESIGNATION

X-405-SP GR-S

X-406-SP GR-S

X-407-GR-S

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Plastics Technology

The Vibrin Resins

R. E. Nelson¹

DURING the war a new group of plas-D tic resins, the polyesters, came into prominence and were used in a number of military applications. Today they appear to be finding expanding industrial uses which promise to make them one of the more important plastics for functional as

well as decorative purposes.

It is believed that the polyester resins will bear watching by rubber products fabricators since they have properties which make them competitive with rubber in a considerable number of places, particularly in impregnating and molding ap-

plications.
United States Rubber Co. now has available a series of polyesters known as the Vibrin resins. They are supplied as clear liquids or wax-like solids, waterwhite or light straw in color. They may be pigmented or dyed to brilliant or pastel

One of the more attractive features of the Vibrin resins is that they lend them-selves to simple and inexpensive fabrication techniques. Only relatively light pressures are required during cure, as no by-products are evolved during the process to form gas pockets in the body of the resin. Thus they are known as "low-pressure" resins. A rapid rate of cure also contributes to low fabricating costs.

These resins may be used in conjunction with decorative materials, such as printed papers and fabrics, colorful fibers, or textured materials, so as to retain the basic beauty of such materials and enhance their properties of strength, translucency, and water, stain, and chemical re-

sistance.

The Vibrin resins offer a choice between flexible and rigid products. They have good abrasion resistance and high tensile, compressive, and flexural strengths. When combined and reinforced with materials such as fabric or glass cloth, structural members may be made with strengths equal to steel on a comparative weight basis. Since they are thermosetting, they are structurally stable, age well, and withstand elevated temperatures well.

Cured Vibrin resins may be machined and polished by conventional methods. In combinations with other materials, with the possible exception of glass, they can generally be treated by standard procedures. Their electrical properties are excellent, particularly at very high frequencies. This feature, combined with excellent mechanical properties, makes Vibrin especially adapted to a variety of electrical equipment.

Chemical properties include a high degree of resistance to water, acids, salt solutions, alcohols, and solvents. Only strong alkalies have any marked effect on Vibrin, but formulations can be made which are quite good in this respect as well. By suitable choice of a particular Vibrin of the series, combined with a proper reinforcing filler or fabric, products may be made which accentuate or blend the more desirable features listed above

The following partial list of products

made with resins of this type indicates their possibilities:

Decorative wall panels Decorative translucent screens Light diffusers and lampshades Toys
Structural parts for aircraft, automotive, and
public transport use
Venetian blinds Veneral Dimos Floor coverings Artificial limbs and other prosthetic devices Boats—dinghies and canoes Furniture and table tops Sporting goods Radar equipment uggage abinets Cannets
Housings for electrical equipment
Panel hoards
Potting or scaling compounds
Castings—decorative and functional
Model making
Heliconter parts

Chemical Nature

The Vibrin resins are compositions of polyesters and cross-linking monomers which, when catalyzed, will polymerize or thermoset to form infusible, solid resins without evolving water or other by-products. Because of the nature of the resin systems involved, the various individual Vibrins can vary widely in properties from one another. Among the properties which can be modified are hardness of the cured resin, flexibility, color, flammability, brittleness, resistance to elevated temperature, viscosity of the uncured resin. rate of cure of the resin, stability of the uncured resin, etc. Although these proper-ties are to some extent interdependent, wide ranges in properties can be obtained to give resins for specific needs. All grades are characterized by excellent resistance to aging and to chemical agents.

The Vibrins belong to the group known

as polyester thermosetting low-pressure resins. They are composed of rather complex formulations of ingredients, but the following basic steps take place:

(1) Suitable alcohols and acids are combined to produce long-chain polyes-ters or alkyds.

(2) These alkyds are blended with other materials, such as styrene, to form the basic Vibrin compositions.

(3) The fabricator adds a catalyst to the Vibrin composition to help start the polymerization reaction which cures the resin.

(4) When the catalyzed Vibrin is in the shape or position desired, heat is applied to bring about rapidly the polymerization reaction.

Types of Resin

Following is a list of typical Vibrin resin types, giving the most important properties. Other types are available for specialty applications.

Vibrin 103: A general-purpose styrene-

base resin with good storage properties. Recommended for general use and evaluation of laminating, casting, and molding projects. (See table for detailed properties

of this resin).

VIBRIN X-1201: A flexible styrene-base resin, similar to the 103 type in storage properties. Recommended for softer, more flexible cured products, it can be blended in any ratio with other Vibrin resins to obtain intermediate flexibility or hardness properties.



Flexible, Transparent Vibrin Resin Sheet

PROPERTIES OF VIRRIN 103

Uncured Resin	
Appearance Odor	Light-straw color Typical styrene odor when un- cured; odorless when cured
Specific gravity	1.16
Viscosity	4 poises
Benzoyl peroxide catalyst	
Granules	0.5-2.0% by weight
Paste	1.0-4.0% by weight
Cured Resin	
Specific gravity	1.28
Shrinkage upon curing	9% by volume
Unnotched Izod impact strer	igth
at room temperature	10 ft.lbs./sq.in
Flexural strength at room t	em-
perature	17,000 psi
Youngs modulus at room t	
perature	240,000 psi
Rockwell hardness at room t	
perature	M-95
Barcol hardness	35
Elongation at break	5-10' (estimated)
Refractive index	1,533
Electrical properties:	
Volume resistivity	6 x 1013 ohm-cms
Dielectric constant (50 cycl	les) 5.1
Loss factor (50 cycles)	0,17
Dielectric strength (0.0	1113-
inch sample)	2,000 volts/mil
Chemical resistance (A.S.T.	М.

7. Absorption 1,05 0,45 0,87 1,0 mical resistance (A.S.T.M. method, one week immersion at room temperature):
Distilled water
30% sulfuric acid
3% sulfuric acid
10% hydrochloric acid 35° sutruice 10% hydrochloric acu-10% nitric acid 10% sodium hydroxide 15° sodium hydroxide 95% ethyl alcohol Acetone Carbon tetrachloride Gasoline 10% sodium chloride 2% sodium carbonate

* Eventually cracks.

VIBRIN 132: A hard, thermal resistant type. It has low viscosity to permit addition of catalyst and impregnation of fabrics, etc., at room temperature and can be readily thermoset at 100° C. or above. It is harder than conventional contact-pressure

harder than conventional contact-pressure resins and retains its strength and hardness better at elevated temperatures.

Vibrin 140: A fire retarding, self-extinguishing resin. It is more viscous than other liquid resins of the series, but is is suitable for laminating, impregnation, casting, and molding.

Vibrin X-1002: A resin generally similar to Vibrin 103, but is practically waterwhite in color.

white in color. VIBRIN X-1007: An air-curing type recommended for saturation and impregnation VIBRIN X-1307: A waxy-bodied, low

¹ Naugatuck Chemical Division of United States Rubber Co., New York, N. Y.

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Impre

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of su build . erties. where odor, non-styrene resin. It cures to a very hard resin of superior chemical resistance.

Impregnation or Saturation

Vibrin resins especially compounded so as to cure with surfaces exposed to air may be employed as impregnants in fibrons or porous structures to cement and strengthen the mass, or to fill entirely the void space and thus add smoothness, weight, strength, translucency, or other property to the end-product. Vibrin resins have found application with paper and paperboard, glass mat and cloth, textile fabrics, vegetable fibers such as sisal and hemp, and other woven or felted fibers, and for impregnation of porous pieces including plaster, metal castings, and briquettes.

Impregnation may consist of only partial or surface treatment, as in the glazing of plaster figures. In such cases a brush application or quick dip into Vibrin may be sufficient. If the surface is especially porous, two or more coats may be applied until the desired resin surface finish is ob-

Undercoats need only be set or gelled before succeeding coats may be applied and, after the final coating, carried to full cure. Most applications, however, require complete saturation which can best be obtained by immersion of the material or piece into the Vibrin resin, preferably deeply so that the air will be displaced more rapidly. Vacuum impregnation of a part with the resin is often resorted to when dealing with materials having very small voids.

Unless the impregnated mass is unusually thick, the cure may be carried out directly at temperatures of 120 to 130° C, without regard to gelation temperature. The cure can be carried out in an air oven, by infra-red or electronic heating, by immersion into a molten metal bath, or in a press either with or without a parting liner.

Lamination

orless

Lamination has been an important use for the thermosetting polyester resins. It served to bring these resins to the fore during the war when they were used in quantity for laminating applications in which the then better-known high-pressure laminating resins were unsuitable.

The polyester resins were termed "low-

The polyester resins were termed "low-pressure" or "contact pressure" laminating resins because, unlike other types, they cure without giving off steam or other gases as a by-product of polymerization and hence do not require high pressure to prevent "blowing" during cure. For this reason it is possible successfully to laminate large sections without resorting to high pressures. A corollary of this feature is that molds and forms for laying up low-pressure laminates may be lightly constructed from a wide variety of inexpensive structural materials. Pressures in the range of approximately 0.5-pound to 100 pounds per square inch are considered as being in the field of low-pressure lamination. However pressures under 30 pounds have most often been used.

Glass cloth and glass fiber, and textile tabrics of cotton, rayon, nylon, etc., may be used as well as fabrics of vegetable fibers such as sisal or jute, paper, and paperboard. Any sheet which can be wet and impregnated by Vibrin resins may be used in constructing a laminate. Multiple plies of these materials, or combinations of such materials, may be employed to build a laminate structure of desired properties. Wood veneers or similar sheets, where good surface adhesion of the Vibrin



Non-Warping, Color Fast, Washable Lamp Shade Made by Polyplastex United, Inc., from Modified Vibrin Resin and Glass Cloth

can be obtained, may be laminated into cemented or non-impregnated constructions.

Single laminations or double laminations of two materials on either side of a light, porous filler, the so-called sandwich constructions, can be laid up and cured at one time. Decorative laminates may be made by using as the surface ply a printed or colored fabric, paper, or woven design. The dyes or pigments used for such effects must be chosen from those which will not run or bleed in the resin. Translucent or solid effects may be obtained by choice of ply materials.

Flat laminates or complicated curved sections may be constructed. In the case of flat or nearly flat laminates, curing is effected between suitable platens, and the process may be laid out for continuous operation from raw roll stock to finished laminate. Curved sections may be laid up either on or in forms, depending upon which side of the laminate is to have the mold design. When laid up on a male mold the laminate and the mold may be enclosed in a molding bag, a vacuum applied, and the assembly cured. Laminates laid up on female molds have a pressure bag or other device to hold the structure against the mold face during cure. Two-part forming dies are also used.

Molds and forms may be made out of practically any material of construction. Solid metal, sheet metal, plaster, wood, and concrete have all been utilized. A mold lubricant is sometimes used, but a separating sheet is often more practical.

High-pressure equipment can be used for curing Vibrin laminates, and very interesting pieces have been made in this way because of the extremely dense structure which results.

A certain amount of drawing or shaping of laminates during the curing process can be done, and certain Vibrin laminates lend themselves to post-forming operations.

For lamination, the Vibrin resin is pre-

pared in the usual manner with 12% catalyst, depending on thickness and curing conditions. The materials to be laminated may be saturated in the Vibrin, or the resin may be applied by roller-coating or brushing, and the excess removed by scrapers or light squeezer rolls. Sometimes the resin is lightly loaded to reduce run down when laying up large laminates. When the waxy or paste-bodied resins are used, the stock can be impregnated while hot, then cooled, and held for use as required. It is important that all air be displaced between the laminants if a strong, light, and smooth construction be required. The laminating fiber should be as dry as possible to eliminate the possibility of steam blistering during cure.

blistering during cure.

Curing time for laminates will depend upon the thickness of the laminate, the manner of heating, the heat conductivity of the form, etc. Thin laminates may be subjected to full curing temperatures from the start, but it is better practice to heat to about 70° C. to produce a good gel structure, and then gradually raise the temperature to 120° C. Thin laminates have been cured in as short a time as three minutes.

Casting

Casting is the most difficult of the technical applications of these resins. No definite instructions can be given to cover all castings, since the size or mass of the resin castings, the mold shape, the material of which the mold is made, and the oven or external conditions all have an influence on the proper technique. However, once the proper procedure has been found for a given casting, the process is easy and regular.

To understand the conditions which must be met in successful casting, it is necessary to understand what happens as the Vibrin cures. When the catalyst (benzoyl peroxide) is dissolved in the resin, the polymerization starts and will proceed slowly even when the resin mass is kept cold. When the resin is first heated, the viscosity is temporarily reduced. At about 50° C. the catalyst becomes more active and polymerization proceeds more quickly. The viscosity increases slowly at first and then quite rapidly until the liquid resin starts to solidity, first forming a weak gel which then becomes progressively stiffer. The curing of thermosetting polyester resins is exothermic, meaning that heat is given off as one result of the reaction. Most of the exothermic heat is due to the gelation of the liquid resin and begins to be noticeable soon after incipient gelation.

When a good gel has been obtained, the temperature may be allowed to build up to the final curing range of 110 to 120° C. to develop the full physical properties of the cured resin. While a set gel may be cooled and then reheated for final cure, best results are obtained when the first gel is carried gradually up to the curing temperatures. If the casting is large, or if the mold is of a material which does not absorb and conduct heat rapidly, the temperature of the resin mass during the gel period rapidly increases. This heat, in turn, speeds up the rate of polymerization so that the reaction may "run away" and generate excess heat.

Heat build-up or rise in temperature, as is well known, causes an expansion of most materials. At the same time the change of state of the resin from liquid to solid is accompanied by an increase in specific gravity, or, in other words, a shrinkage in the resin mass takes place during gelation. Hence during gelation we may have

the opposing actions of temperature expansion at the same time the liquid is shrinking to a solid state. At gelation the resin has not attained its final strength properties, and a poorly controlled casting procedure will result in fractured castings or highly strained structures due to these opposing forces. It is evident then that the gel period is the critical interval in casting, and temperature rise must be under control for best results.

It is possible with certain accelerators, termed promoters, when added to the catalyzed resin, to obtain a gelation of resin without application of external heat. Thus the viscosity drop of heated systems is avoided, pigments do not settle, and the gelation and exothermic reaction occur at a lower temperature where it may be better controlled. After the exothermic action the cure is carried on in the same manner as in the heat-promoted gel.

Best casting results are obtained when the catalyst has been allowed to mellow in the resin for about 12 hours or overnight at slightly below room temperature. Preparing the resin the day before using makes for smoother casting. This holding period also allows entrapped air to escape. It is recommended that the catalyzed resin be stored at a temperature of 50 to 70° F with continuous gentle agitation. Under these conditions catalyzed Vibrin remains liquid for two to three days.

Contour Molding

In molding, Vibrin-impregnated plies or compositions filled with Vibrin resin are pressed into shape during the curing process. In essence the process is a combina-tion of laminating and casting, and in general the same techniques are employed as described above.

Dyes

Vibrin resins may be dyed in a complete range of attractive transparent colors by the use of properly selected dyes. The dye may either be added directly to the resin and stirred into complete solution, or dissolved in a small amount of a suitable solvent (i.e., benzene, acetone, alcohol, etc.) and then added to the resin. Scitable pigment colors may also be used for opaque coloration by either grinding the pigment in the monomer resin, or by adding a color masterbatch in a suitable vehicle to the

New Treatment for Polystyrene Plastics

NEW treatment known as Logo-A quant, makes possible the use of polystyrene in applications heretofore requiring the use of much more expensive plastics The treatment is fully developed for production line application, either by spray-ing or dipping, and does not require spe-cial equipment or curing at high tempera-The treatment can be completed in 15 minutes, using standard equipment. The Logoquant treatment depends on actual fusion between the polystyrene and resistant materials, and is not a mere surface coating. The treated polystyrene is said to be visually indistinguishable from un-treated polystyrene even when transparent plastics is used, and the treated surface cannot be peeled off by any known mechanical means.

Several years ago a study by the Nash-Kelvinator Corp. revealed that polystyrene resins would be excellently adapted many automotive uses were it not for three disadvantages: (1) proneness to scratching of the surface; (2) destructive action of common cleaning fluids, gasoline, and oil; and (3) electrostatic attraction for dust. The Bjorkstein Research Laborates tories were employed to work out a practical solution to this problem, and the Logoquant treatment is the result of this work. The process and materials are pat-ented, but the Bee Chemical Co., has been licensed to manufacture and sell the Logo-The process and materials are patquant materials for treatment of polysty-

The Logoquant treatment imparts to olystyrene a mar resistance said to be 18% higher than that of the untreated plastic, 7% higher than that of a good spar varnish, and in the same order of magnitude as much more expensive plasties, as measured by A.S.T.M. Method D 673-44. When marred, the treated polysty-rene can be polished to clearness much more readily than can the untreated plastic. In addition the treated plastic is considerably less electrostatic than the unpolystyrene. Logoquant polystyrene resists wiping and brushing with gasoline, mineral oils, carbon tetra-chloride, and toluene, all of which attack untreated polystyrene.

CALENDAR

- Oct. 3. Chicago Rubber Group. (Original-
- ly planned for September 12.) Boston Rubber Group. Fall Meet-Oct. 3. ing. Hotel Somerset, Boston. Mass.
- National Association of Waste Material Dealers, Inc. Fall Con-Oct. 4-6. vention. Ritz-Carlton Hotel, Atlantic City, N. J.
- Oct. 6-7. Packaging Machinery Manufacturers Institute. Fifteenth Annual Meeting. Hotel Sheraton, Springfield, Mass.
- Oct. 6-10. National Safety Council. Thirty-Fifth National Safety Congress & Exposition. Chicago, Ill. Oct. 7.
- The Los Angeles Rubber Group, Inc.
- Oct. 9. Southern Ohio Rubber Group. Gem City Club, Dayton, O.
- Oct. 14. Buffalo Rubber Group. Sheraton, Buffalo, N. Y. Oct. 16.
- Akron Rubber Group. Oct. 21-First Pacific Chemical Exposition. Civic Auditorium. Also Northern
- California Rubber Group Sessions. Oct. 24. New York Rubber Group. Fall Meeting, Hotel McAlpin, New York, N. Y.
- Oct. 24 Detroit Rubber & Plastics Group, Inc. Detroit-Leland Hotel, Detroit. Mich.
- A.S.I.M. New York District. Engineering Societies Bldg., 33 W. Oct. 30.
- 39th St., New York, N. Y. Chicago Rubber Group. Oct. 31. Nov. 5-7.
- American Society of Body En-gineers, Inc. Annual Convention. Rackham Memorial Bldg., Detroit, Mich.
- Connecticut Rubber Group. Nov. 14. Twenty-First Exposition of Chemi-Dec. 1-6. cal Industries. Grand Central
- Palace, New York, N. Y.
 American Society of Mechanical Dec. 2-5. Engineers. Annual Meeting.
- Los Angeles Rubber Group, Inc. Dec. 2. Philadelphia Rubber Group. Kug-Dec. 5.
- ler's Restaurant, Philadelphia, Pa. Dec. 8-13. Annual Automotive Service Industries Show. Navy Pier, Chi-
- cago, Ill. Buffalo Rubber Group. Christmas Dec. 9. Party.
- Dec. 12. Boston Rubber Group. Christmas Party. Hotel Somerset, Boston, Mass.
- Dec. 12. New York Rubber Group. Christmas Party. Hotel McAlpin, New York, N. Y.
- Detroit Rubber & Plastics Group, Inc. Annual Christmas Party. Dec. 12. Detroit-Leland Hotel, Detroit, Mich. Dec. 18.
- Southern Ohio Rubber Group. Christmas Party. Chicago Rubber Group. Christ-Dec. 19.
- mas Party. Society of Automotive Engineers. Jan. 12-16. Annual Meeting. Book-Cadillac
- Hotel, Detroit, Mich. Ian. 12-Second National Materials Hand-16. ling Exposition. Public Auditorium, Cleveland, O.

Pyroxylin-Coated Fabrics and Paper

The following are the figures for pyroxylin-coated fabrics and paper for the second quarter of 1947, as reported by the Bureau of the Census, United States Department of Commerce. The statistics are based on reports from 27 companies and represent the operations of processors who coat or impregnate fabrics or paper with soluble cotton or pyroxylin preparations, either separately or in combination with other materials. "Light" cotton fabrics include sleetings and print cloths; "heavy" cotton fabrics include frills, ducks, sateens, broken twills, and moleckins. All figures are given in linear yards, except for pyroxylin spread and monthly capacity, given in pounds.

Total (except non-fabric materials): *	April	May	June
Shipments Unfilled orders †	8,419,203 9,928,231	7,121,382 8,177,231	6,033,961 7,778,264
Light cotton fabrics:			
Shipments Unfilled orders †	4,713,304 5,675,704	4,399,288 4,611,909	3.305,926 3.757,241
Heavy cotton fabrics:			
Shipments Unfilled orders †	2,547,599 3,624,953	2,023,592 3,012,177	1,873,659
Custom coating: ‡			
Shipments Unfilled orders †	1.158,300	698,502 553,145	854,376 881,416
Non-fabric materials:			
Shipments Unfilled orders †	224,098 156,820	147,210 143,007	104,026 142,285
Pyroxylin actually spread, lbs. Monthly capacity, § lbs.	6,667,321	5,725.772 16,722,847	4,556,689 16,722,847
a Day 1 d d d d d d d d d d d d d d d			

Data include an undetermined quantity of custom coating of non-fabric materials.
 Orders on hand at the close of the month, exclusive of contracts, with shipping dates unspecified.
 Data for fabrics other than cotton are included with custom coating to avoid disclosing data for individual establishments.
 Based on all machines suitable for pyroxylin coating, assuming 600 working hours per month of entire production on 53"-1.32 sateen coated to a finished weight of 17.5 oz./linear yd., assuming 40% solids.

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RUBBER WORLD

NEWS of the MONTH

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In spite of a falling off in the demand for certain rubber products both at home and abroad during the summer months, no very great drop in industry activity resulted, and according to in-dications during September, the tem-porary lull in some lines has passed and the production of all rubber goods and the production of all rubber goods is again approaching the peak rate of the first half of the year. Natural rubber may now be used in any amount in almost all products except transpor-

tation items where the previous government specifications are retained. Tire manufacturers pleaded not guilty to the complaint of the Department of Justice on price fixing. An advertisement for "bids" for prices on 10,000 long tons of natural rubber for stockpiling by Treas-ury Procurement raised the market ury Procurement raised the market price of this rubber about a cent a pound. The annual convention of the URWA, held in Boston in September resulted in the reelection of L. S. Buckmaster as president and an indication that this CIO union is in favor of full compliance with the Taft-Hartley law.

long tons; GR-S, 31,007; neoprene, 2,534; Butyl, 4,178; and nitrile types, 306.

New supply and production of the various rubbers in July was: natural, 57,243 long tons; GR-S, 25,978; neoprene, 1,942; Butyl, 3,490; and nitrile types, 507.

Stocks on hand at the end of July were: natural, 141,352 long tons (the difference between this figure and the much higher

natural, 141,352 long tons (the difference between this figure and the much higher figure of last month represents, in part, rubber consigned to the strategic stock-pile): GR-S, 63,656; neoprene, 5,008; Butyl, 18,334; and nitrile types, 4,120 tons. With the greater use of natural rubber

permitted in non-transportation items and with the continued 18½¢-a-pound price for GR-S insisted on by RFC, as compared with the 16½¢-a-pound price for natural rubber, the consumption of GR-S is expected to appropriate the consumption of GR-S is expected to consumption of GR-S is expected to consumption of GR-S is expected to constitute the consumption of the constitute of the constitut pected to continue to decrease during the remainder of the year. Most manufacturers are expected to change their compounds to take advantage of the lower natural rubber price and at the same time gain the

somewhat better processing advantage of this type of rubber.

Standard & Poor's Corp., New York, in another one of its "Industry Surveys" on tires and rubber, issued on September 17, the profit for the second surveys. predicted a substantial net profit for the rubber goods industry for the year 1947, despite some evidences of a downtrend. Tire production, which set a new record in the first half of 1947, will decline in the final six months, according to this report. been reduced, labor costs are higher, and lower natural rubber prices have neces-sitated inventory writedown. sitated inventory writedowns, it was pointed out. On the other hand, early gains in the tire division and sharp expansion in other activities will hold full-year sales close to the peacetime record of 1946. While profits of most rubber fabricators will fall below the all-time peaks of last year, earnings should still be excellent, and recent dividend rates will be covered by

wide margins, this report stated.

The RMA regular report on tire production, issued on September 19,1 gave production of passenger-car tires for July as 5,474,573 units, a decrease of 10.29% as 5,474,573 units, a decrease of 10,29% from the previous month. The drop was attributed to inventory and vacation shutdowns in many plants. Shipments for July were 6,111,564 units. Truck and bus tire production was also off 11.17% from June; 1,315,208 units were made. Shipments rose slightly to 1,329,077 units.

The several branches of the rubber goods industry should be interested in the results of a nation-wide survey recently made public by the magazine, The Hotel Monthly, Chicago, Ill., which states that 88% of the hotels with 100 or more rooms are planning a rehabilitation program involving a total expenditure of about \$382,000,000. A potential market of \$8,264,098 is estimated for rubber, asphalt, ceramic, glass, and glaze floor coverings, of which over \$3,000,000 may be spent on rubber and asphalt tile. The market for upholstery fabrics is estimated at \$1,000,000. The purchase of \$23,500,000 worth of mattresses and bed springs is contemplated, of which a portion might very well consist of mattresses made of foam sponge rubber. The survey was made by the C. C. Chapelle Co., marketing consultants, and is described in detail in a 100-page publication distributed by *The Hotel Monthly*.

According to a report attributed to Everett G. Holt of the United States Depart-ment of Commerce, the volume of exports of rubber goods from this country is be-ginning to decline. Rubber goods exports totaled \$54,790,000 during the first three months of 1947 and \$58,241,000 in the sec-

Industry Activity Continues at High Level; R-1 Order Again Revised

Manufacturing activity in most branches of the rubber goods industry continues at a high level. Some branches, such as soles and heels and tires, which had reduced production somewhat during the summer months because of a leveling off in demand, are now operating at higher production rates again. Rubber Order R-1 was revised once more by the Office of Materials Distribution to remove controls over the use of natural rubber in most products except tires and tubes. This action plus the purchase by the government of 10,000 long tons of natural rubber for stockpiling caused the natural rubber market to rise somewhat with the price increasing from 15.5 to 16.5¢ a pound during September somewhat with the price increasing from 15.5 to 16.5¢ a pound during September. Tire manufacturers appeared in the Federal Court, Southern District of New York, N. Y., September 16 and entered a plea of not guilty to the complaint of the Department of Justice on price fixing. November I was set for the filing of mo-tions by the defendants. Appearing in the same court on the same day was counsel for the Brake Lining Manufacturers Asso-ciation, also accused by the Justice Department of price fixing and conspiring to eliminate competition. The date of October 7 was set for hearing of pleas in this case. It was announced that the House Armed Services Subcommittee would begin an inspection tour and hold hearings at various synthetic rubber plants in Texas, Kentucky, and Ohio on November 13, in connection with the formulation of long-term legislation on rubber policy early in 1948.

Industry Activity and Outlook

The peak production rate attained by the rubber goods industry during the first half of 1947, which declined somewhat in certain branches during the summer, is now being approached again in most lines. In the tire branch new premium and white sidewall tire production has at least par-tially taken the place of the production of standard grade tires lost when the replacement demand slackened a few months ago. Increased output of automobiles has also increased the original equipment demand

The mechanical goods field reported the highest production rate in its history for the 12 months ending June 30, 1947, and no reduction in that rate is indicated for the near future. A backlog of orders for all kinds of belting and other mechanical goods except some types of hose will keep the manufacturers of these products operat-

ing at a peak rate for several months.

The footwear branch is still heavily booked with orders for standard items, and development and production of new items are not possible of realization until pent-up

demand is more completely satisfied.

The sole and heel branch, particularly those companies supplying shoe manufac-turers, has greatly increased its output dur-ing the past month. Shoe manufacturers, who had been marking time during the first half of the year because of expected consumer resistance to high prices, decided late in the summer that there was a market for their product even at the higher prices and stepped up production. With the shortage of leather the demand for rubber and composition soles rose to new heights. If more crepe rubber were available for soling, an even greater activity would be evident in the sole and heel field, but it is not expected that there will be anywhere near the 1948 demand.

With increased supplies of natural latex

and more liberal control regulations, production of latex goods is definitely beginning to reach sizable proportions. Arthur Nolan, of Latex Distributors. Inc., writing in Lockwood's September Rubber Report states that as supplies increase, more and more latex will be allowed by the OMD for use in foam products. Meanwhile this infant industry will probably run at full rate of present and expanding capacities by augmenting its *Hevea* rations with synthetic latex, Mr. Nolan added. The future of foam latex products remains shining and bright with the realization that for the first time in the existence of the foam la-tex industry it can look for a reasonably steady, stable cost for its principal ingre-dient, with future prospects of this cost being reduced, it was added.

Consumption of natural and synthetic rubber in the United States during July dropped to 78,309 long tons, as compared with June consumption of 85,109 long tons, according to OMD. Consumption according to the during July ing to type during July was given in a preliminary estimate as: natural, 40,284

1 See page 114.

ond quarter. The monthly average for the second quarter was \$19,400,000, but the exports for June amounted to only \$17,600,000 and in July dropped to \$15,960,000. Tires and other transportation items are accounting for nearly 70% of all the rubber industry's exports. Many foreign countries which have been buying heavily in this country since the war are getting their own rubber factories in production, and they are also able now to obtain enough natural rubber to keep them running. However, if the Marshall plan is approved by Congress and if a large part of the aid sought by the European countries includes rubber goods, exports by U.S. manufacturers may not decline further, it was pointed out.

The Anti-Trust Suits

The arraignment of eight tire manufacturing companies, ten company officials, and The Rubber Manufacturers Association Inc., on charges of violating the Sherman Act, was postponed from September 9 to September 16. On the latter date defendants appeared at Federal Court, Southern District of New York, and pleaded not guilty. Judge Stephen W. Brennan set November 1 as the date for filing motions on the charges, and trial date was not fixed pending disposition of any motions.

On the same day, counsel for the Brake Lining Manufacturers Association, also accused by the Department of Justice of price fixing and conspiring to eliminate competition, appeared in this court and asked that October 7 be set for the hearing of pleas by this Association. This request

was approved by the court.

The B. F. Goodrich Co. in a release issued to its employes early in September on the subject of anti-trust allegations said

in part;

"The suit filed in New York against eight tire manufacturers and the Rubber Manufacturers Association is, apparently, part of a pattern which the Anti-Trust Division seems to be carrying out with the objective of indicating to the public its zeal to hold down prices. Those associated with the tire business in the United States hardly need any reassurance as to the fierce competition traditional in this industry. You, as members of the B. F. Goodrich organization, know that we do not fix prices for other manufacturers, nor do outsiders conspire to fix our prices.

"Tire values to the consumer are not only extraordinary today, but they have been conspicuous among all values to the consumer for many years, going far beyond the 1935 date mentioned in the complaint...

"If the industry had ever conspired to its benefit at the expense of the consumer, such action would certainly have been most apparent through the recent period of severe shortages.

"Such a complaint brought by the Anti-Trust Division poses problems for the company. Similar actions against other industries have dragged on in the courts for years, and regardless of the outcome, have taken thousands of hours of the time of people who have important jobs to do day in and day out in the running of their companies.

"You can be certain that the primary concern of the management of your company is for the integrity and reputation of The B. F. Goodrich Co., and that any attempt on the part of anyone to damage this integrity through false allegations will be bitterly fought. In the meantime, the American public, which has seen many Anti-Trust actions filed in the past, has come to learn that the criticisms stated in a legal complaint are only the view of one

party who has started the argument. We are sure that the public will see this one not only in the light of what the Anti-Trust Division has alleged, but in the light of what they know about the values and low prices which the manufacturers of tires have consistently given them."

R-1 Order Revised

The Office of Materials Distribution of the Department of Commerce revised R-1 on September 9 to permit the use of natural rubber in most rubber products except tires and tubes. Natural rubber latex may be consumed in any product except foamed rubber, curled animal hair, and certain types of insulated wire, which are subject to individual product specifications. The new control formula will result in estimated consumption of GR-S at a rate of one-third of total GR-S and natural rubber processed, it was said. All inventory restrictions are removed as is the requirement for prior authorization to accept or consume natural rubber of natural rubber at the processed of the product of the processed of the product of the processed of the product of the

In his September Rubber Report, W. S. Lockwood points out that in July, 71,291 tons of GR-S plus natural rubber were consumed. Two-thirds of this figure is 47,526 long tons. Under the R-1, before this latest revision, 40,284 tons of natural rubber were consumed. However, if total consumption falls off for the remainder of the year, the new R-1 may not increase the demand for natural rubber appreciably.

It is, of course, impossible to estimate with any degree of accuracy what the actual consumption of natural and GR-S rubbers will be under the new revision. Some fabricators will immediately abandon GR-S completely; while others will try to continue using it by preference, but as long as the price of GR-S is maintained two or more cents a pound above that for natural rubber, the preferential use of GR-S will be most difficult.

Government Buys 10,000 Tons Natural

As Lockwood points out in his September Report, the action of the Treasury Department in advertising for "bids" for 10,000 tons of natural rubber for stockpil-

ing may drive the price of this rubber higher than necessary if this ill-advised routine method is continued by the government purchasing agency. The desirability of a major stockpil n program is obvious, but the method needs considerable and speedy overhauling. A program is needed with which the manufacturing industry agrees fully; then personnel trained in buying rubber is needed in Treasury Procurement to carry it out.

Apparently this government agency saw the error of its ways for a statement appeared in the newspapers on September 10 to the effect that the government has no immediate plans for ma-ing any further purchase of natural rubber levond the 10,000-ton purchase already announced. It was explained that this does not mean that the government will make no further purchases, but it was emphasized that such purchases would not be made "in the immediate future."

Government Carbon Black Plants Sold

The Odessa, Tex., channel carbon black plant operated during the war by United Carbon Co. has been sold for \$4,300,000 to S. W. Richardson, Fort Worth, Tex., an independent oil and gas operator, the War Assets Administration stated on September 17. The plant, one of the largest built by the government to meet wartime needs, consists of 670 buildings on 426 acres of land. It has a capacity of 45,000,000 pounds of carbon black annually. The property includes 416 burner buildings with sheet-iron coverings, 10 warehouses, miscellaneous smaller buildings of steel frame, burners, scrapers, conveyors, pulverizers, machine shop equipment, and loading and bagging machinery.

Another government channel black plant at Eunice, N. M., operated under interin lease by Panhandle Carbon Co., was offered for sale or lease early in September. This facility consists of 168 burner buildings, processing buildings, bag storage building, warehouse, machine shop, change house, office building, and a treater plant including a gas purification system, boiler house, laboratory, and 8½ miles of 20-inch pipeline. The land area of the property totals about 140 acres. It is understood that several bids were made for this property, and sale to one of the leading carbon black manufacturers will be approved within a few weeks.

Management-Labor Relations

Reports from the annual convention of the United Rubber Workers of America (CIO) in Boston, Mass., during the week of September 14 indicated that this union was likely to comply with the new Taft-Hartley Lalor Act, if such a policy was approved by the parent CIO national union. L. S. Buckmaster was reelected president of the URWA. The B. F. Goodrich Co. and its various local URWA unions reached an agreement for six paid holidays rather than a further wage wage increase at the present time. Negotiations between the Firestone Tire & Rubber Co. and the local URWA unions were held on the wage increase problem during September on a plant level, and negotiations between United States Rubber Co. and the URWA on this same subject began in New York on September 23.

The URWA Convention

About 550 delegates from the local URWA unions and the officers of the international URWA met in Boston, Mass.,

from September 14 to 19 for their annual convention. L. S. Buckmaster, president of the URWA, in his opening speech stated that if labor will get cases before the new National Labor Relations Board and if the Board breaks down, organizations will be better able to challenge the effectiveness of the Taft-Hartley Law and get the support of the American people. He also outlined a program to serve as a guide for local unions which included an improved welfare plan embracing hospitalization, medical care, insurance, etc., better public relations, and more efficient organization of local unions.

The delegates voted an amendment to the constitution to permit local unions to collect dues from \$1.50 to \$3 per month from their members, but the amount the international union will get from each member a month remained at 70¢. Field representatives of the union were voted seniority rights. The delegates approved resolutions in favor of a stronger United Nations organization, a government pro-

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on un.American activities. Mr. Buckmaster and Charles E. Lanning were reelected unanimously to the positions of president and secretary-treasurer respectively, of the international URWA. H. R. Lloyd was reelected vice president by a vote of 999 to 641 over Joseph W. Childs. A motion to amend the union constitution to permit the election of a second vice president was defeated, and another motion to make the office of organizational director elective instead of appointive was also unsuccessful.

gram to take care of those laid off in the

rubber industry, government public works projects to take care of future unemploy-

ment, a more forceful government program

to reduce the cost of living, support of an

anti-poll tax law, and the transfer to the Federal Bureau of Investigation of the activities of the Thomas-Rankin committee

G. L. Patterson, general counsel for the URWA, in a talk to the delegates during the closing hours of the convention com-plimented them on their achievements in securing wage increases and a substantial degree of corporation-wide bargaining during the past year, but then emphasized that the success of the union in keeping these agreements was going to depend on how the members behaved under them.

"If we don't prove to those companies and other companies that we mean to keep our contracts once we make them, they may retreat behind the Taft-Hartley Law. and there won't be any way of forcing these agreements in the future," Mr. Patterson said.

"We have a job to do. We have a responsibility to assume. We must maintain a relationship with those employers who are not seizing upon all the ramifications and all the booby-traps in this law to wreck your union," he added.

The liability of the union for unfair la bor practices, breaking contracts, political contributions, etc. was reviewed, and it was pointed out that the union had not felt as yet the effects of the law as much as it would in a year or so. Contracts in effect the day the law was enacted are good until they expire or until July 1, 1948, but if at that time the union had not convinced the employers with whom it dealt that the URWA was entitled to a little better treatment than that the law requires, there would be some real prob-

Mr. Patterson concluded by cautioning the delegates to be careful to avoid any action that would result in a destructive suit of one kind or another against their union, since, as he put it, if the employers of this country want to use the Taft-Hartley Law to its fullest advantage, organized labor could be completely strangled,

The Wage Increase Demand

It was announced on September 7 that a new contract had been signed on a company-wide basis between The B. F. Goodrich Co. and the URWA for six paid holidays instead of any further direct wage increase at the present time. The contract also provides for reopening discussions on the general wage scale on 60 days' notice, improved grievance procedure, and severance awards for long-term work-

Thus both the Goodyear and Goodrich companies have settled for the moment the problem of wage increases as asked for by the URWA on July 22. The negotiaby the URWA on July 22. The negotiations on this subject were continuing between the Firestone Tire & Rubber Co. and its local unions at a plant level. The Akron local union voted on September 7 to notify the new NLRB of a wage dispute and therefore became the first union to use the provisions of the Taft-Hartley Act in the rubber industry. Negotiations between United States Rubber Co. and the URWA on the wage increase question be-

gan in New York on September 23. On September 26, United States Rubber Co. and the URWA issued a joint statement that representatives of the union and the company, who had been negotiating on wages had reached an agreement whereby the company will pay straight time for six holidays when not worked. The agreement is retroactive to and included Labor Day, 1947. This agreement, which covers New Year's Day, Decoration Day, Independence Day, Labor Day, Thanksgiving, and Christmas, conforms to the pattern recently established by other rubber companies and also by the general industry, it was said.

Rubber Restrictions Reduced

Government controls over use of natural rubber in the manufacture of some 30,000 non-transportation items were eliminated September 9 in a sweeping revision of Rubber Order R-1, the Office of Materials Distribution. United States Department of Commerce, announced last month.

Use of synthetic rubbers will be concentrated in the transportation field, principally in tires and tubes, OMD explained, until Congress enacts legislation establishing a long-term national rubber policy.

This revision of R-1 is in line with the government's policy of rescinding the few remaining wartime controls as rapidly as supply conditions permit, OMD said. Adequate quantities of natural rubber are now available for most other uses, it was pointed out. Changes in the order were decided on after consultation with other interested government agencies and the Rubber Industry Advisory Committee.

The new control formula will result in estimated consumption of the principal syn thetic rubber, GR-S, at a rate of one-third of total GR-S and natural rubber processed. This ratio was determined nearly two years ago by the Inter-Agency Committee on Rubber to be adequate to support the synthetic rubber industry required for national security. Use in tubes of GR-I (Butyl), in amounts considered essential to national defense, also is provided for in the revised order.

Tire specifications remain unchanged in R-1. Popular-size passenger-car tires, 6.00 "load rating" cross-section and smaller, will continue to be manufactured with an overall use of not more than 23% natural rubber, as will industrial, implement, and front farm tractor tires. Rear farm tractor and all other farm implement tires continue with a limit of 13% natural rubber. The larger sizes, 6.50 and up, of passenger and industrial tires will continue to rate not more than 67% natural rubber. "Tolerances" permitted in these sizes, however, will be increased from 10 to 20%. This means that a manufacturer may turn out at least two grades of tire, containing dif-ferent amounts of natural rubber, so long as his use of natural in his total production of these tires does not exceed the stipulated percentage. Airplane and inter-city bus tires, up to 11.00 cross-section, may contain up to 94% of natural rubber. Larger sizes are unrestricted.

All inventory restrictions are removed by the revised order, as is the requirement for prior authorization to accept or con-sume natural rubber or natural rubber latex from any source. However manufacturers who wish to purchase GR-S or GR-I will continue to make purchase re-

quests to the Office of Rubber Reserve These changes eliminate a considerable volume of paper work, OMD said.

Other points in the revised order of interest to manufacturers are: (1) increase to 2,000 pounds per quarter of the amount of natural rubber that may be used ex-perimentally; (2) use of 100 pounds of natural latex per quarter for experimental purposes; (3) retention in large measure of current rubber end-product import re-strictions. The revised order will allow import of any product, manufacture of which is permitted in this country, but will restrict import of any upon which specifications are imposed domestically.

Concentration of controls in the field of transportation items will greatly simplify administration of the order, officials added.

Sears Joins RMA

W. James Sears, who recently resigned as chief of the Rubber Division, Office of Materials Distribution, United States Department of Commerce, has joined The Rubber Manufacturers Association, Inc., New York, N. Y., as vice president, according to an announcement by the Association on October 2. Mr. Sears served the rubber industry through the war and re-conversion period in several key govern-ment positions. He had joined the Office of Production Management in July, 1941, and then been successively with the War Production Board as assistant director of the Rubber Bureau, and with the Civilian Production Administration as director of the Rubber Division. Prior to the war Mr. Sears was employed by the United States Rubber Co., in Detroit, Mich., and therefore brings to his new position considerable familiarity with the problems of the industry.

Synthetic Rubber in Japan

(Continued from page 87)

tries, Ltd.; Nippon Tire Co., Nippon Carbide Industrial Co., Ltd., Sumitomo Chemical Co., Ltd.; Mitsui Chemical Industries Co., Ltd.; and Nitchitsu Synthetic Rubber Mfg. Co., Ltd. Among the subjects covered are the manufacture of monomers, vinyl acetylene, butadiene, acrylonitrile, vinyl acetylene, butadiene, acrylonitrile chloroprene, and their polymerization products. Flow sheets for these processes and for the manufacture of synthetic crepe are given. Also included are tables of data on materials, power, and fuel requirements, and several Japanese patents on synthetic

rubber and intermediate products are listed.

The report, PB-50912, entitled "Synthetic Rubber Manufacture," comprises 62 thetic Rubber Manufacture, comprises 62 pages and is available in photostat form for \$5 and in microfilm form for \$2. Orders should be sent to the Office of Technical Services, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order payable to the Treasurer of the United States.

The Flintkote Co., 30 Rockefeller Plaza, New York 20, N. Y., won the bronze "Oscar of Indust y" trophy for its 1946 annual report, which was judged best in the building materials industry by Financial World in its annual report survey. Presentation will be made to Flintkote President I. J. Harvey, Jr., at the annual report awards banquet at the Hotel Pennsylvania, New York, October 10.

EASTERN AND SOUTHERN



E. M. Cushing



Pach Bros.

Russell Wilks

U. S. Rubber Promotes Several Executives

Herbert E. Smith, president of the United States Rubber Co., 1230 Ave. of the Americas, New York 20, N. Y., last month announced two major changes in executive personnel.

E. M. Cushing, supervisor of labor relations, has been made industrial relations director of the company.

Russell Wilks, manager of publicity, has been appointed public relations director for

U. S. Rubber.
William M. Dougherty has been appointed assistant to the president of U. S Rubber. Mr. Dougherty joined the company's commercial research department 25 years ago and spent several years at the tire plant in Detroit, Mich., coordinating production and sales. In 1934 he was placed in charge of the central sales and production coordination department and in 1941 was elected an assistant secretary. In his new position as assistant to President Herbert E. Smith, Mr. Dougherty will remain

an assistant secretary of the corporation.

Albert W. Holmberg has been named manager of latex, Lotols, and dispersions Naugatuck Chemical, according to of George R. Vila, manager of colloids and plastics for the division. Mr. Vila also announced the transfer of Gerald L. Den is from the New York to the Philadelphia area, as Robert R. Sterrett is rejoining the company to replace Mr. Dennis as New York area representative. Clarence H. Sigler has been made special technical representative on Mr. Holmberg's staff.

Mr. Holmberg has been with the rubber company since 1909, except for a period of military service during World War I. Starting as a laboratory technician in the Mishawaka plant, he was later transferred to the general laboratories in New York and then to New Haven, where he served as laboratory assistant and chemist. He joined the Naugatuck staff in 1929 and for many years directed development work on latex and dispersions. For the last four years he has been in the sales department at Naugatuck.

Mr. Dennis was graduated from Nebraska State Teachers College and obtained an M.A. degree at Colorado State Teach-

ers College. He was chemistry instructor and athletic coach in Nebraska high schools until 1941, when he became senior schools until 1941, when he became semor supervisor at the Kankakee Ordnance Works, operated first by E. I. du Pont de Nemours & Co., Inc., and later by U. S. Rubber. After the war he was transferred to the Lotol laboratory in Naugatuck and in 1946 was made New York area sales representative. representative.

Dr. Sterrett studied at Purdue University and then obtained a Ph.D. degree at University of Illinois in 1935. The following year he started development work on Lotols, synthetic rubber, and other products at Naugatuck Chemical. In 1943 he became development director for Julius Schmid, Inc.

Mr. Sigler attended Kansas City Junior College and the University of Kansas. In 1942 he worked in the technical department of Pennsylvania Ordnance Works, operated by U. S. Rubber. The next year he started three years of research in latex and dispersions at the Naugatuck plant, entering the sales department in 1946.

Mr. Vila also announced opening of a new branch office for sales of latex, Lotols, and similar liquid rubber products at Fifth

and Locust Sts., Philadelphia, Pa., under the charge of Mr. Dennis.

H. Barden Allison has been made sales manager of the Gilmer division, V-belt manufacturing and distributing unit in Philadelphia. Mr. Allison's former position was district sales manager of mechanical goods in the Cincinnati district; he also has held positions in Cleveland and Indianapolis. He started his rubber career 29 years ago as an order clerk in U. S. Rubber's Philadelphia office.

Mr. Allison's successor at Cincinnati is Ralph W. Stambaugh, a salesman there.

Other personnel changes in the company's mechanical goods sales organization were announced as follows: Purdy Miller, district sales manager in Buffalo, has been appointed district sales manager in Indian-appolis; N. W. Swenson succeeds him at Buffalo. Paul S. Bigby, assistant district sales manager at Detroit, has been named district sales manager at Milwaukee. A new rubber hose with increased strength and lighter weight has been developed by U. S. Rubber for handling propane and butane petroleum gas. The hose, pane and butane petroleum gas. The hose, made of a special synthetic rubber compound capable of resisting the effects of liquefied petroleum gas, is reinforced with Ustex yarn, a chemically treated cotton textile having high strength and low stretch characteristics. The hose will be molded in continuous lengths in three sizes: ½-, ¾-, and 1-inch inside diameters and will be handed every five few sizes: ½-, ¼-, and I-inch inside diameters and will be branded every five feet with the name, U. S. Giant L. P. G. hose. It is intended for use primarily in transferring liquefied petroleum gas to homes, factories, and other points from supply truck and storage tank.

truck and storage tank.

An insect poison said to be four times as potent as DDT against certain insects was recently announced by U. S. Rubber. Extensive laboratory tests of the insecticide, called Synklor, show it to be particularly powerful against such household pests are completed and corner beetles. as roaches, ants, moths, and carpet beetles, according to John P. Coe, vice president and general manager of the Company's Naugatuck Chemical division. Synklor is also being tested on many other insects and so far shows promise against house flies, cotton boll weevils, Japanese beetles, cucumber beetles, and about 35 other kinds of insects. The insecticide is both a contact and stomach poison, Mr. Coe stated, and has prolonged residual action, clinging to walls, ceilings, and window screens up to three months and to outdoor foliage for weeks. The active chemical in Synklor is chlordane, an abbreviated term for octachloro-4, 7-methano-tetrahydroindane, and is reported to be no more toxic to humans than DDT. Synklor is available either as a liquid or as a dust. One liquid is a refined grade for household use, called Synklor 20-C. The agricultural grades include Synklor 50-W, a wettable powder; Synklor 5-D, a dust; and Synklor 48-E, a liquid spray concentrate.

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Hercules Powder Co., Wilmington, Del., has announced that for the first time in six years Parlon, the company's chlorinated rubber base for concrete paints and other protective coatings, is now readily available. Completion of new production facilities at the company's Parlin, N. J., plant and an improvement in the natural rubber supply situation were given as the reasons for the availability of Parlon. Since its introduction in 1935, Parlon has won widespread acceptance from protective coating manufacturers for use in both concrete and metal finishes. The material is also used to fortify long-oil alkyd enamels, in paper coatings for food packaging, in flameproof cloth coatings, in adhesives, and for specialty inks. Because of the availability of Parlon, the chlorinated synthetic rubber, Parlon X, manufactured during the shortage of natural rubber, will no longer

Woburn Chemical Corp. (N. J.), Harrison, N. J., has named Assistant to the President Ward L. Atwood to the position of sales manager to succeed Vice President Richard O'Rourke, who has resigned that post because of ill health. He will, howsever, continue serving the company on special industrial relations projects. Mr. Atwood joined Woburn in 1940 and was in charge of the export division prior to being made assistant to the president. He is a graduate of Rollins College and a member of Theta Kappa Nu. RLD

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Changes at Thermoid

Fred Schluter, president of The Thermoid Co., Trenton, N. J., last month announced several important organization changes.

M. R. Bell has been made assistant rubber production manager-assistant to Lesber production manager—assistant to Les-ter F. Cox. vice president for production at Thermoid. A native of Chicago, Mr. Bell attended schools there and was grad-uated with the degree of mechanical en-gineer from the Case School of Applied Science in Cleveland. After several years in plastic development work with the National Carbon Co., Vinylite division, Cleveland, he became associated with the aeronautical division, The B. F. Goodrich Co., on the correlation of designs for aircraft components. He next spent four years in war production as plant manager for the aeronautical division of Pharis Tire More recently he has been engaged in consulting and design and has also been active in the widely expanding labor rela-

L. I. Berry has been appointed production engineer for the molded hose division. Coming to Thermoid after serving as superintendent of construction and installation of new equipment for the Hewitt Rubber Co. Buffalo, N. Y., Mr. Berry also devoted many years to molded hose development and many years to monted nose development and production with the United States Rubber Co., and its subsidiary, Mechanical Rubber Co. of Cleveland. A native of Cleveland, Mr. Berry attended local schools and then matriculated at Hiram College, where he majored in engineering. During the war he served first as plant engineer and subse-

quently as works manager for the Warren City Tank & Boiler Co. Commenting on the assignment, Mr. Schluter said, "The expansion of Ther-production of the comment of the control of the co production facilities to keep step with the growth in the company's sales, necessitates the selection of a number of trained and experienced men for our several plants. Mr. Berry's wide experience in engineering and rubber production dovetails with the requirements at Thermoid's new plant at Nephi, Utah, where we expect to be in full production by the first

of the year."
Phil "Red" Shafer, former driver, owner. and builder of racing cars, has been named as fleet sales and service engineer for Thermoid, where he will have charge of fleet engineering and service work in the Mid-west area, with headquarters in Chicago. A native of that sector of the country, the former speed driver was born in Des Moines and was educated both there and in Salt Lake City. Prior to the war Mr. Shafer was with the Buick Motor Co. and he was field engineer for the Packard Motor Co. More recently he was district manager for The Perfect Circle Co., Hargestown Ind. gerstown, Ind.

Miss Miriam C. Ronga, former central New Jersey representative of Mademoiselle. has been added to the advertising staff of Thermoids' automotive division, as adver tising assistant specializing in layout and copy, and follow-through activities on copy, and follow-through activities on printing production. A graduate with a B.A. degree from the advertising-journal-ism course at Georgian Court College, Miss Ronga previously engaged in retail advertising in the department store field. She has also taught journalism at Georgian

Davison Advances Pettit

Arvil B. Pettit has been appointed protection engineer for the operations division



A. B. Pettit

of The Davison Chemical Corp., Baltimore 3, Md., it was announced by G. M. Hebbard, vice president of operations. In his new position Mr. Pettit will be responsible for the overall development of the fire prevention and safety programs of the operations division, which includes Curtis Bay and Cincinnati, and the phos-phate rock division.

Mr. Pettit came to Davison from the Office of Rubber Reserve, RFC, where he was manager of the Safety Section and was manager of the Safety Section and responsible for the safety, fire prevention, and security program of the agency's 51 synthetic rubber program plants. He started with the Goodycar Tire & Rubber Co. as a member of its flying squadron and graduated with honors from the intensive three-year course in the manufacture of rubber products and business administra-tion. He was later sent to England by the company to train supervision and key personnel in the operation of a new plant employing 2,000 workers.

In 1940, Mr. Pettit was among those

selected by Goodyear for training in synselected by Goodyear for training in synthetic rubber production. He was manager of the safety and personnel training division of Goodyear Synthetic Rubber Corp. when, in February, 1943, he was loaned to the government to assist in the administration of the government's synthetic rubber program. Mr. Pettit joined Davison on February 10, 1947, as assistant training supervisor for industrial relations. At the request of Monsanto Chemical Co., he was loaned to that organization for a short time to participate in the investigation of the Texas City disaster.

Taylor Promotes Noble

At a recent directors' meeting of Taylor Instrument Cos., Rochester 1, N. Y., Her-bert J. Noble, vice president and treasurer, was elected executive vice president and assistant general manager. He will retain his position as treasurer. Mr. Noble joined Taylor in 1907 as an accountant. In 1934 he was elected a director, in 1938 treasurer, and in 1946 vice president. His experience with the organization parallels the period of its expansion into an international com-pany with plants in Canada and England and sales outlets throughout the world. His keen business judgment was an important factor in the success of these un-dertakings. He is also chairman of the financial executives committee of the Recorder-Controller Section of the Scientific



Herbert J. Noble

Apparatus Makers of America, a former director of the Rochester Section of the Controllers Institute of America, and a member of the National Association of Cost Accountants and of the Rochester Chamber of Commerce.

William D. DeCourcy recently reported to the Pitttsburgh office of Taylor Instrument Cos. as industrial sales representative, to cover the western counties of Pennsylvania, Allegheny County, as well as part of West Virginia. Mr. DeCourcy is a graduate of the University of Michigan with a degree in mechanical engineering. During the war he was assistant to the chief engineer aboard a fleet destroyer. Harold M. Messenger, who will cover part of North and South Carolina out of

the Atlanta office, completed a course the Atlanta office, completed a course in electrical engineering while he was with the U. S. Army. He received his degree from Union, which he entered in 1939. During the war he served in Italy as a battalion survey officer, assistant intelligence officer, and athletic officer.

Traflet Heads Reclaiming Firm

Following the death, on July 18, of its president and founder, Joseph F. McLean, Pequanoc Rubber Co., Butler, N. J., announced new officers elected on August 22 as follows: president, Frederick E. Traffet; vice president, Thos. N. D. Mace; secretary-treasurer, (Miss) M. T. Gunter; assistant treasurer, Newton H. Tuthill. Mr. Traffet, who went to the company

Mr. Traflet, who went to the company in 1923 as chief chemist, has since served

in 1923 as chief chemist, has since served as assistant superintendent, technical superintendent, assistant secretary, and vice president. On September 11, Mr. Traflet was also elected a director of the American Hard Rubber Co., New York, N. Y.

He was born in Newark, N. J., April 4, 1897, and attended Yonkers grade and high schools and New York University, graduating in 1919 with a B.S. in chemical engineering. Then he found employment with the Habirshaw Electric Cable Co., Yonkers, N. Y., where he remained until

Yonkers, N. Y., where he remained until joining the rubber reclaiming concern.

Mr. Traflet lists his hobbies as photography and radio. He was an instructor with the United States Signal Corps during World War I and during the second served on a number of technical committees in Washington, including the Rubber Bureau of WPB, Rubber Reserve, and OPA.



Frederick E. Traflet

He holds membership in the Masonic Order, Chemists Club of New York, Rotary Club, American Legion, American Chemical Society, and the Rubber Reclaimers Association, Inc., in which last organization he now is vice president. Besides Mr. Traflet is one of the most active and one of the original members of the New York Rubber Group, of which he was chairman in 1942. He is also on the Butler boards of health and education.

R. T. Vanderbilt Co., Inc., 230 Park Ave., New York 17, N. Y., has awarded a contract for the construction near Fowler, N. Y., of a mill designed to produce 250 tons of talc daily. The company's development plans for the mine call for the sinking of a vertical shaft to a minimum depth of 800 feet. When the mill is com-pleted and fully equipped, Vanderbilt will process the tale under new production techniques. This will mark Vanderbih's initial entry into the tale producing field in this area. The company specializes in the manufacture and technical selling of chemicals and minerals. The tale deposits, located in St. Lawrence County and known since pre-Revolutionary days, have been described by geologists as among the largest in the world. Tale has many impo: tant industrial uses, with only a relatively small percentage used in the production of talcum powder and cosmetics. One of the largest users of tale is the paint industry, but it is also used in the production of ceramics, rubber, and paper.

W. A. Cleary Corp., 254 W. 31st St., New York, N. Y., according to Vice President L. Russell Cook, is expanding its lecithin sales from the food industries to the general process industries, where an increasing demand for this product has been noted, particularly in the paint, rubber, and textile industries. In line with this program William N. McKee has been appointed industrial sales manager of the company, in charge of sales of the new Cleary line of germicides, fungicides, and herbicides. Mr. McKee formerly was with Shell Oil Co., with which he had been associated since 1936 except for his period of war service. Upon his return to Shell in 1945 he was employed in the naphtha, solvents, and process materials section of the company's sales department in New York.

Hanson Joins Snell Staff

Foster D. Snell, Inc., firm of consulting chemists and engineers, 29 W. 15th St., New York 11, N. Y., has announced that Ernest R. Hanson has joined its staff to head up research and development in the field of plastics and rubber. Dr. Hanson, a graduate of Fargo College, Fargo, N. D., did graduate work at Northwestern University, receiving his Ph.D. degree in 1925 He then joined Halowax Corp. as chief chemist and contributed to the development of the plastic halogenated naphthalenes, as well as the vinyl acetate-chloride copolymers, in coatings having high resistance to water, flame, and electricity. In 1940 he transferred to the research department of the Bakelite Corp., Bloomfield, N. J., and there continued his work on the development of plastics, particularly of the polyethylene family and its application in extruded form as electrical insulators. Dr. Hanson has been granted nine U. S. patents for his inventions in the plastics field and is the author of a number of scientific papers in the field of organic chemistry. He also belongs to American Chemical Society (councilor of North Jersey Sec-tion, 1938-1939); American Institute of Chemical Engineers; Fellow of the American Institute of Chemists; The Chemists' Club (New York); Sigma Xi; Alpha Chi Sigma Fraternity (secretary, 1933-1947),

New York Professional Chapter.
Snell held a press party on August 26 and conducted a tour of the company's new quarters. The firm is housed in a 10-story building having approximately 22,000 square feet. Purchased in 1945, the building required extensive alteration and modernization not yet entirely finished. The roof is used for exposure panels for studying protective coatings. The tenth floor is devoted to the analytical department. The ninth floor consists of Dr. Snell's office and laboratories for research groups working under his direction, particularly on surface-active agents. The business and general office occupies the eighth floor, together with the accounting and market research offices. The seventh floor has research groups working under Cyrus S. Kimball, company vice president, and also includes the building maintenance office. The company library and records room occupy part of the sixth floor, the remainder of which is devoted to synthetic organic chemical research. General laboratories, including those for rubber, occupy the fifth floor, and the fourth floor is devoted to bacteriology and toxicology. The third floor houses physical measurement and physics and chemistry research. The stock room and maintenance shop occupy the second floor. The ground floor comprises the reception room and telephone switchboard, with the rear of the floor being given over to pilot-plant work. The basement contains the building's heating plant and adequate storage space.

A. Schrader's Son, Division of Scovill Mig. Co., Brooklyn 17, N. Y., its beginnings, growth, and present status, were featured in the August-September, 1947, issue of Essa Oilteays, published by Standard Oil Co. of N. J. The story covers in great detail the various Schrader plant manufacturing activities, with many illustrations of production processes and product applications. The history of the company is traced from its inception in 1844, by August Schrader, as a specialty machine shop, up to the present time. Although the company is known all over the

world for its tire valves, the article points out that Schrader manufactures many other types of valves, including valves for gas-type cream whippers, air-containing undercarriages and landing struts for air-craft, industrial flow operations, insecticide spray containers, humidifiers for hot-air furnaces, and for pumping nitrogen gas into electric power cables. The company also manufactures many other products, including air-pressure gages and chucks, diving helmets, air control attachments for presses, vulcanizers for attaching rubberbase replacement valves, valve fittings and tools, water adapters for tractor tire valves for use in filling tires with liquids, spark plug tire pumps, and blow guns.

Witco Chemical Co., 295 Madison Ave., New York 17, N. Y., recently purchased the Phillips Petroleum Co.'s interest in the Panhandle Carbon Co. All the production of channel carbon black by Panhandle Carbon will be marketed, as in the past, by Witco.

In 1933, Robert I. Wishnick acquired Panhandle Ca; bon, Borger, Tex., and shortly thereafter disposed of half interest to Phillips Petroleum, which has, since that time, supplied the natural gas necessary for the operation of the plant. Mr. Wishnick was elected president of Panhandle Carbon and still serves in that

capacity.

When it became evident in 1944 that additional supplies of channel carbon black were essential for war purposes, Panhandle Carbon was first to submit plans to the War Production Board for an additional plant to be located at Witco, N. M., and brought the plant into operation within five months.

J. M. Huber Corp., 342 Madison Ave., New York 17, N. Y., has announced through President H. W. Huber, that Edward M. Krech has joined its staff as director of purchases. He will coordinate all purchases for the ink, industrial products, clay, and oil and gas divisions and will make his headquarters in Brooklyn. Prior to joining Huber recently, Mr. Krech for 12 years was in the sales and purchasing departments of the Singer Mfg. Co. He is a graduate civil engineer from Cornell University.



Fred Wittner

Edward M. Krech

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Adding to Plastics Staff

The Glenn L. Martin Co., Baltimore 5, Md., has made T. F. Montgomery head of the engineering section of its plastics and chemicals division at Painesville, O., and chemicals division at Painesville, O., which manufactures vinyl chloride-type resins. There he will work under the direction of Chief Engineer W. J. Lightfoot. A graduate of Waynesboro College and Lehigh University, Mr. Montgomery first worked for the Youngstown Sheet & Tube and the Thomas Steel companies and for the last nine years was with the fundamental and process development group of the chemicals plant division of Blaw-Knox Construction Co., Pittsburgh, Pa.

The plastics and chemicals division has also added three members to its sales and technical service staff: Willard de C. technical service staff: Willard de C. Crater, Eugene C. Hilkert, and Ira B. Wheeler, Jr., who will bring to the division's customers the full facilities of Martin technical service laboratories in Baltimore and render all possible assistance in the solution of specialized manufacturing problems and who will report to H. M. Parsekian, director of sales and stabilities assisted. technical service.

Mr. Crater attended Tome School, the University of Delaware, and Rutgers University, majoring in chemistry throughout. From 1938 to 1943 he was with the Herrom 1938 to 1945 he was with the Hercules Powder Co. in its experimental plastics laboratory and from 1943 to 1947 was
employed by the Federal Telephone &
Radio Corp., first as supervisor of research
on plastic cable components and later as
supervisor of the vinyl plastics plant.

Mr. Hilkert, a graduate of Notre Dame
in 1942 with a bachelor's degree in chemical engineering, was employed by the

ical engineering, was employed by the ical engineering, was employed by the Koppers Co., where he was engaged in butadiene and styrene production and development. During 1945 and 1946, Mr. Hilkert was in military service and assigned to the Los Alamos Project.

Mr. Wheeler, a graduate of Princeton in 1942 with a B.A. in chemistry, served in the Coast Guard nearly four years and from May, 1946, until July, 1947, was plant superintendent at the Cordo Chemical Co.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has appointed Ernest J. Braun director of sales of the fabrics division of the fabrics and finishes department, with headquarters in New York, This department handles the production and distribution of products of the company plants at Newburgh, N. Y., and Fairfield, Conn., which manufacture all types of coated fabrics and other products types of coared fabrics and other products generally marketed under such names as "Fabrikoid," "Fabrilite," "Cavalon," "Fairprene," "Ventube," and "Rug Anchor".

Mr. Braun joined du Pont in 1926 as

a clerk in the Fairfield plant. His subsequent positions follow: 1929, salesman of rubber products, headquartered at Chicago; 1932, salesman of bookbinding products in New York; 1935, special representative in Chicago for the promotion of neoprene-coated fabrics; 1938, salesman for bookbinding and medicate in products in heoprene-coated fabrics; 1936, saksinal bookbinding and upholstery products in Chicago; 1945, supervisor of sales of bookbinding products, New York; April, 1947, assistant manager of "Fabrikoid" sales in New York; September, 1947, director of sales, fabrics division.

Mr. Braun's promotion completes a series of changes in the division's management following the recent death of M. J. Callahan, manager since 1941. J. R. Buckley. assistant manager, became manager; and Max N. Nickowitz, director of sales, became assistant manager.

MIDWEST

Transfers at Link-Belt

Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill., last month announced the following changes in sales management personnel:

James B. Elliott, divisional manager for Caldwell plant products, with headquarters at the Caldwell plant in Chicago, has been appointed divisional sales manager at the company's plant in Minneapolis, Minn. Elliott, a native of Superior, has been with Link-Belt since 1925 and has served as district sales engineer for Minnesota, Wisconsin, and the upper peninsula of Michigan.

Erwin A. Wendell, district sales manager, Chicago branch, with headquarters at the Pershing Rd. plant, has been appointed divisional sales manager for Caldwell plant products, with headquarters at the Caldwell plant. Mr. Wendell entered the employ of the Pershing Rd. plant engineering department in 1918. Among various positions held was district sales managership at St.

Louis from 1937 to 1944.

T. W. Matchett, district sales engineer at New York, takes over Mr. Wendell's former post. Mr. Matchett, a mechanical engineer graduate of Lehigh University, 1931, joned the Link-Belt sales department in Chicago early last year after 13 years experience in the shop, erection, engineering, and sales department of an eastern conveyor manufacturer. At time of leaving he was secretary of the company.

Julius Tumpeer, one of the founders of Witco Chemical Co. (originally Wishnick-Tumpeer, Inc.), has started his own company. Known as Tumpeer Chemical Co., the new firm has offices at 333 N. Michigan Ave., Chicago, Ill. Mr. Tumpeer is very well known in the rubber industry by virtue of biby virtue of his more than 25 years association with it.

Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill. on September 2 an-nounced the election of two new vice presidents and the reelection of other officers of the Mechanics Universal Joint Division. C. E. Palmer, former works manager, was named vice president in charge of manufacturing for both of the division's plants—the one in operation at Rockford, Ill., and the one now under construction in Memphis, Tenn. The other new vice president is Fred M. Potgieter, who will have charge of truck, agricultural and aviation, sales implement, industrial, and aviation sales. G. C. Gridley was reelected president and general manager, and R. R. Rolph vice president in charge of automotive sales.

Bjorksten Research Laboratories, 185 N. Wabash Ave., Chicago 1, Ill., has added two new members to its staff: Marian C. two new members to its staff: Marian C Stoffel, technical secretary, and Harry De-Walt, Jr., research chemist. Miss Stoffel was graduated from Mundelein College with a B.S. degree in chemistry, after which she became a research assistant with the Illinois State Geological Survey, Urthe Illinois State Geological Survey, Urbana. Next she was an executive secretary for the Nylen Products Co. Mr. DeWalt has a B.A. degree in chemistry from Temple University. During the war he served three years with the U. S. Signal Corps in the China, Burma, India Theater.

N. S. C. Membership Drive

Robert M. Boyles, director of industrial relations for Midwest Rubber Reclaiming Co., has been named Roundup Boss of the National Safety Council's Rubber Section, as part of the Council's Fall Roundup drive for new members. Mr. Boyles will assist John Young, supervisor of safety for International Harvester Co., in pointing out how accident prevention can lower business costs. The Roundup, which will extend from October 1 to December 31, will be featured by a contest among the various sections of the Council.

The importance of membership in the National Safety Council to the growing accident prevention movement is shown by the growth of the Council from a membership of 40 industrial concerns in 1913 to its present membership of 7,500. As the Roundup progresses, rubber industry mem-bers of the Council will be kept closely advised of developments. The Rubber Section campaign will stress the fact that this is a rubber industry project in which the Section's activities are managed and di-rected by an executive committee composed wholly of rubber industry men serving on a voluntary basis.

Changes at Monsanto

Monsanto Chemical Co. St. Louis, Mo., last month promoted six staff members of its central research department at Day-

Wendell P. Metzner, a research group leader at the department, has been advanced to associate director of research in the rubber service department of Monsanto's organic chemicals division at Nitro, W. Va. Dr. Metzner first joined Monsanto in 1936.

Rudolph L. Heider, with the company since 1940, and Alfred B. Craig, who came to Monsanto in 1943, have been appointed group leaders of the process research and plastics evaluation groups, respectively, at the central research department. They

have been acting group leaders of these groups for several months.

Earl C. Chapin, affiliated with Monsanto since 1944, has been appointed acting group leader of a polymer research. leader of a polymer research group at Dayton, replacing Dr. Fordyce. Dr. Metzhas been succeeded as acting group leader of another polymer research group by George L. Wesp, whose service with Monsanto started in November, 1945, after several years with E. I. du Pont de Nemours & Co., Inc., and Curtis-Wright

Reid G. Fordyce has been made sales development manager of the plastics divi-sion, at Springfield, Mass., and Edmund S. Childs has been made assistant manager of the sales development department.

Dr. Fordyce, a research group leader at the central research department, Dayton, O., replaces C. L. Jones, Jr., recently appointed sales manager for the protective coatings department of Monsanto's Merrimac Division. Dr. Fordyce received his degrees of B.A.Sc. and M.A.Sc. in chemical contentions of the University of Brite. cal engineering at the University of Brit-ish Columbia and his Ph.D. in chemistry from McGill University in 1939. He then joined the central research department as a research chemist and in July, 1945, was appointed group leader for polymer re-

Mr. Childs, a graduate of Harvard University with a B.S. in chemical engineering in 1940, entered the plastics division sales department the same year and in 1942 was placed in charge of Vuepak sales

in the New York area. Later that year he was made assistant superintendent of maintenance and construction at the Merrimac Division, Everett, Mass. In January, 1946, he was assigned to product development work in Springfield and a year later was transferred to Cincinnati as sales representative.

Robert L. Rickenbacher has been appointed senior sales representative for the plastics division on the Pacific Coast. He replaces R. J. Lambert, who recently re-reglaces R. J. Lambert, who received signed. Mr. Rickenbacher, who received a B.S. degree in 1941 from the University of Ohio, joined Monsanto that year. Transof Oho, Johied Monsanto that year. Trans-ferred to the West Coast from the St. Louis office, he will be headquartered at Monsanto's Los Angeles, Calif., office at 605 W. Olympic Ave.

E. S. Blake has been appointed assistant director of research for the Merrimac division at Everett, Mass. Dr. Blake, who was graduated from the University of Michigan in 1931, served until 1936 as a chemist for the State of Michigan. Then he joined Monsanto as a research chemist

in the rubber service department of the organic chemicals division at Nitro. In 1942 he was promoted to group leader in

the department.

C. L. Parish has been made maintenance superintendent at the Monsanto plant at Anneston, Ala. He previously had been electrical engineer for the phosphate division at Anneston. Mr. Parish joined the company in November, 1938, as an electrician at the plant at Columbia, During the war he served with the U. Army and returned to inactive duty in February, 1946. Mr. Parish succeeds Herbert . Tittel, now production superintendent of Monsanto's plant at Trenton, Mich.

John W. Stewart has been added to the New York sales and development staff of the textile chemicals department. His duare concerned with the introduction to the trade of the company's textile chemicals. His headquarters will be in Monsanto's new offices at 445 Park Ave., New York, N. Y. Mr. Stewart, until recently New England representative of the Aqua-See Corp., has spent more than 16 years in the textile industry. For ten years he was a technical representative for General Dyestuffs Corp. He is a graduate of Lo-well Textile Institute and a member of the Grand Council of Phi Psi.

R. L. Bauer and R. E. Lenz have been appointed assistant managers of the process section of Monsanto's general engineering department, F. G. Gronemeyer, department department, F. G. Grønemeyer, department director, announced September 23. Mr. Bauer will be the senior assistant and will assume responsibility in the absence of the section manager. Work of the section will be generally divided along technical and administrative lines, with Mr. Bauer primarile and administrative lines, with Mr. Bauer primarile and administrative lines, with Mr. Bauer primarile and administrative lines. marily responsible for the technical phase. and Mr. Lenz for the administrative phase.

Mr. Bauer received a B.S. degree in chemical engineering from Washington University in 1937. He was employed by Monsanto in that year at the Monsanto, Monsanto in that year at the Monsanto, Ill., plant, but later worked successively for W. G. Shelton Co., National Compounding & Chemical Co., and E. I. du Pont de Nemours & Co., Inc., and while with the last was active on the Manhattan Project and at the Hanford Engineer Works. Mr. Bauer rejoined Monsanto in 1945 in the general development department and was transferred to the process ment and was transferred to the process section of the general engineering department in 1947.

Mr. Lenz received his B.S. chemical engineering from Washington University in 1940. He was employed by Monsanto that June as a research chemical

engineer at Anniston, Ala., was transferred to Dayton, O., in 1942, to the general develepment department at St. Louis in 1945.

and to the process section of the general engineering department in 1947. Arnold H. Smith, acting managing di-rector of Monsanto (Australia), Pty. Ltd.. has been elected vice president and a director of Monsanto (Canada), Ltd., to assume these duties January I, 1948, William M. Rand, president of Monsanto Chemical.

announced September 29.
At the same time Mr. Rand announced that Irving C. Smith, vice president and a director of Monsanto (Çanada), has resigned, effective January 1, to accept promotion to assistant general manager of Monsanto's western division, with head-quarters at Seattle, Wash.

Arnold Smith joined Monsanto in March, 1922, in the rubber service laboratories at Akron, O. From 1930 to 1940 he was with Monsanto Chemicals, London and on the Continent. Subsequently he was petroleum chemicals sales manager in St. Louis. On October 1, 1945, he became director of the foreign department and in December, 1946, went to Australia to survey Monsanto's postwar possibilities

Irving Smith came to Monsanto in June, 1944, when I. F. Laucks, Ltd. was pur-chased. Since August, 1944, Mr. Smith hrs served as a director of Monsanto (Can-ada). Then in March, 1946, he was elected vice president of the company. In addition Mr. Smith has been vice president and managing director of Laucks, Ltd., of Van-conver, and a director of Laucks (Eastern) Ltd., at Montreal.

PACIFIC COAST

Plant Rubber & Asbestos Works, San Francisco, Calif., has made C. J. Colman general assistant to Vice President A. J.

The Golden Bear Oil Co., refiner and manufacturer of petroleum and petroleum products, Oildale, Calif., is entering the field of manufacture of rubber chemicals through its newly created chemicals divi-sion, which will supply high-boiling hydrocarbons and derivatives to the western rubber industry. The research facilities of the company, being reorganized and expanded, will include a modern rubber testing laboratory. Although the company does not sell its petroleum products di-rectly to industrial dealers or consumers, the new division will deal directly with the rubber trade wherever direct contact and service are essential. The by-products of the company's present processes will serve as the raw materials for the contem-plated chemical manufacture. The new division will announce and offer its products to the rubber industry upon completion of the present preparatory and testing stage.

Fritz S. Rostler is director of research and development of the new division. Dr. Rostler was previously research professor of chemistry in the Engineering Experiment Station, University of Delaware, and is well known in the rubber industry by virtue of his pioneering work in the field of plasticizers and extenders. Dr. Rostler will be assisted by Richard M. White, former research assistant at the University of Delaware.

OHIO

Promotions by Goodrich

Several changes of executives have been announced by The B. F. Goodrich Co., Akron.

L. R. Keltner, superintendent of the Akron tire division has been named manager of the Los Angeles, Calif. plant, succeeding P. W. Perdiau, who assumed Mr. Keltner's former post in Akron. Mr. Kelt. ner joined Goodrich in 1926, after graduation from the University of Missouri, where he majored in chemistry. After serving in the company's general laboratories two years, he entered the tire division as a compounder. Superintendent of the Akron tire division since 1945, he had previously been assistant technical su-perintendent of the division and handled

the war.

Mr. Perdiau, a graduate of Harvard University in industrial chemistry, has been with the company since 1934, starting as a chemist. He was in deicer production during the war years and had been

many special technical assignments during

manager of the California plant since 1945. Herman C. Wey has been appointed assistant to W. E. Ireland, manager of passenger-car tire sales of the replacement tire sales division. Mr. Wey came to the company in 1933, as a junior clerk in the Oklahoma City district. He was sales promotion manager of the Kansas City district from 1934 to 1942, when he entered the Armed Services. On his return in 1946 he entered the company's sales promotion department in Akron. Mr. Wey succeeds Edin J. Lewis, now manager of petroleum company sales.
Fred C. Schulz has been named operat-

ing manager of the associated lines sales The division division of Goodrich Co. handles the sales of Brunswick, Diamond, Hood, and Miller products. A graduate of Ohio State University, Mr. Schulz has been with the company since 1935. He started in the Cleveland district as budget manager and has been in the credit and operating departments since 1936, recently as a district credit manager for the tire

Stritch, manager of the George Detroit district of the automotive, aviation, and government sales division of the Goodrich company, completed 30 years' service last month. Starting in the company's insulated wire department as a clerk on September 17, 1917, he came to Detroit in 1920 as a clerk in the office he now heads. He has held his present post since 1936.

A new adhesive, claimed to have more than twice the shear resistance strength of brass rivets in anchoring automotive brake linings and to eliminate all danger of rivetscoring of brake drums, has been developed by Goodrich in collaboration with one of the country's major auto concerns. The material, said to be entirely synthetic, will be used starting this fall in the auto company's commercial vehicle brakes, and ultimately in its passenger cars. The adhesive, called Plastilock 601, is a secret formula. According to Goodrich, the two chief advantages of the adhesive are that the brake lining can be worn right down to the shoe before requiring replacement, and there is no possibility of rivet heads cutting ridges in the brake drum. Tests conducted by the auto company showed that rivets start to shear at 3,500 pounds and fail at 5,000 pounds; while lining attached by Plastilock 601 held fast until 11,000 pounds of shearing pull were ape been

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Butaprene AAA

- Low Swell in Oils and Greases
- Easy Processing Tubes Without Plasticizers

FO	RMULA		NORMAL PHYSICA Slab Cures 20' x 3	
Butaprene NAA		100	Stab Cures 20 x 3	112 F.
Medium Thermal Blac	k	100 Tensile	e psi	
Zinc Oxide		··· 5 Flore	ation %	555
Antioxidant		4		
T.M.T. Disulfide		3 Duron	neter A	63
Santocure		3		
TOTAL				
		OIL RESISTANCE		
Medium	Hours Time	Temp. °F.	Volume Change	Durometer
ASTM No. I Oil	70	300	-3.09%	58
	70	212	1.72%	58
	70	158	-0.43%	53
	70	80	+0.80%	53
ASTM No. 3 Oil	70	300	+8.00%	45
	70	212	+7.47%	47
	70	158	+4.44%	48
	70	80	+0.98%	53
		FUEL RESISTANCE		1
SR-10 Fluid	70	80	+2.86%	53
SR- 6 Fluid	70	80	+38.00%	33

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I, Ohio.

AMERICA'S most VERSATILE ELASTOMER

plied. The new adhesive was developed specifically for brake lining use, but is part of a whole new family of adhesives that will have thousands of applications, the Goodrich company further declared. Available in either tape form or liquid, Plastilock 601 requires a fairly severe curing period of applied heat and pressure. It will be available in the near future for relining brakes of commercial and passenger ve-

One of the newest uses for sponge rubber is for lining the metal chutes of fruit grading machines, according to Goodrich. Using sponge 's-inch thick, the rubber lining protects fruit against bruising during sorting and also lessens the vibration and noise by fruit dropping into the chutes.

Goodrich rubber hose is being used by an Arizona grain company to unload wheat by suction. Flexible metal tubing previously used for this purpose broke frequently owing to failure caused by the friction action of the wheat. In addition, the metal tubing was too hot to touch. when the system was in operation, and was also heavy and cumbersome. A 35-foot length of six-inch diameter rubber hose permits the grain to be transported at high velocity, and its smooth lining produces less friction than did the metal hose.

Introduces New Tire

Seiberling Rubber Co., Akron, recently announced a new heat-resisting tire claimed to be the "most nearly failure-proof" made since the war. According to J. L. Cochrun, company vice president in charge of sales, the tire was designed not primarily for extra mileage, but for safety, and it represents a complete departure from the recent trend toward extra tread thickness in premium auto tires.

"We have found that too much weight or thickness in tire treads means a sacrifice in safety," Mr. Cochrun said and explained that Seiberling's new "safety" tire had been built as light and strong as pos-sible, borrowing some of its construction features from tires built for racing cars.

The principal characteristic of the new is its resistance to heat, accomplished by the elimination of excess weight, by shaping its contours to approximate its position when being driven and thus minimizing flexing heat, and by patented "heat in the shoulder which are said to ventilate the tread area and dissipate ex-

Seiberling's New Safety Tire

cess heat. Rayon cord fabric which has been prestretched to avoid tire growth is



Dwaine Edsall

General Tire Advances Edsall

Promotion of Dwaine Edsall to production manager of the Akron plant of The General Tire & Rubber Co. was announced. last month by Harold J. Harmon. Mr. Edsall succeeds Mr. Harmon, who recently was made factory superintendent.

General foreman of tubes and accessories prior to his advancement, Mr. Edsall has been with General 25 years. He joined the company immediately after graduation from Central High School (Akron) and has worked in production, as supervisor in the tread room and mill room, as general foreman in the calender division, and as general foreman of beads, final inspection, repair, and airbags.

He is 43 years old and is the father of

two children. He and his family live at 151 Mission Dr., Akron. Selection of Glenn E. Curtis as territory representative for Colorado with headquarters in Pueblo was announced recently by F. T. Settle, Denver branch manager of General Tire. A former Air Corps pi-lot with combat service in ETO, Mr. Curtis served as a safety inspector in du Pont's Denver Ordnance plant prior to his military service. He has had previous

sales experience with insurance organizations. Mr. Curtis is married and the father of three children.

Forms Plastics Subsidiary

Roger S. Firestone has been named president of the Firestone Plastics Co., a new subsidiary, Harvey S. Firestone, Jr., president of The Firestone Tire & Rubber Co., Akron, announced last month. plastics company will manufacture and distribute the complete line of Firestone plastics. Headquarters will also be in Akron. Continued expansion of Firestone's line

of plastic products is the reason for incorporation of the new subsidiary com-

At Pottstown, Pa., a new, modern plas-tics laboratory recently was completed for extensive research and development work, This is in addition to the large producing units installed in the Pottstown plant dur-ing 1946 and 1947. Velon sheeting is em-bossed, printed, or finished with a patent gloss, for upholstery use, women's handbags, shoes, luggage, and many other uses: Velon film is calendered for shower curtains, rainwear, and many other products;

for weaving into beautiful fabrics for upholstery At Paterson, N. J., Velon plastics are mixed, extruded, and fabricated for use in such items as insect screening and plastic

and Velon plastic filaments are extruded

clothesline. Approval by the CAA of the cross-wind landing gear for tricycle gear aircraft, made by The Firestone Tire & Rubber Co., marks another step toward the establishment of single-strip airports from which properly equipped planes can operate with safety. The Firestone installation in-corporates a rubber torsional conical disk assembly with the SuperFlex rubber spring landing gear to enable the wheel to caster. Perfected under a CAA-financed development contract, the new landing gear was tried out experimentally on an Ercoupe. In flight tests the plane has landed in cross winds up to 35 m.p.h. velocity at 90 degrees with highly satisfactory stability and control characteristics, and such landings are regarded as perfectly safe for the average pilot. Upon impact of landing, the wheels caster so that the plane can maintain a heading into the wind up to a 30-degree angle to the runway. As speed decreases and the Superflex absorbtion unit expands after impact compression through the action of the torsional restraint assembly, the wheels return to their nor-

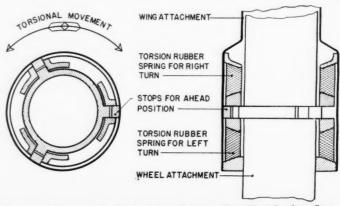
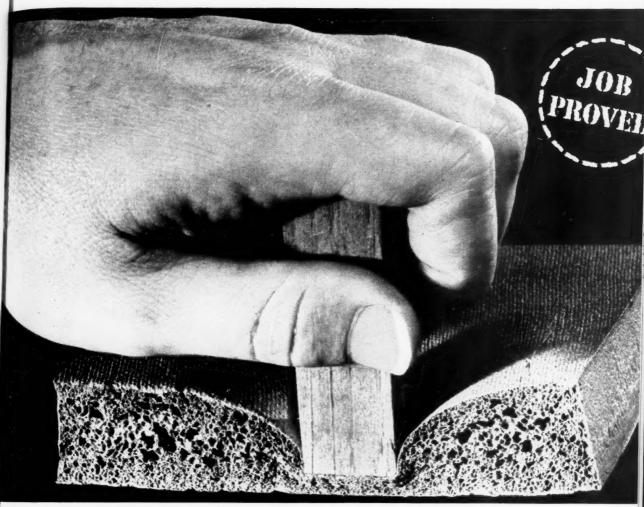


Diagram of Operating Principles of New Firestone Cross-Wind Landing Gear for Airplanes

Cuts Migration Troubles In GR-S Sponge



CIRCOSOL-2XH...

Used by Leading Manufacturers of Sponge Rubber

"Our chief reason for using Circosol-2XH," says the research director of a prominent manufacturer of rubber sponge, "is that it is less migratory."

This Company uses Circosol-2XH in processing sponge rubber which is later cemented in place with the common reclaim rosin-type adhesives.

After testing Circosol-2XH they found it softened the rubber satisfactorily and did not migrate, "bloom" or affect the cement as ordinary processing oils did. Circosol-2XH gives them a margin of safety in manufacturing and helps to make possible higher production and more satisfactory application.

Circosol-2XH is a processing aid, refined by Sun as an elasticator for GR-S. It is widely used throughout the industry to speed up processing and to increase the resiliency of finished GR-S products. For complete information on Circosol-2XH and other "Job Proved" Sun processing aids for rubber, write Department RW-10.

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normal taxiing procedures.

Appreciation of the work done by Firestone on the landing gear was expressed by John Geisse, CAA consultant and father of the gear development project, and by Lloyd Child, personal flying develop-ment assistant to T. P. Wright, CAA ad-

ministrator. William S. Wilson, assistant manufacturers sales manager for Firestone for the last 15 months, has joined the staff of Firestone's Detroit manager, D. J. Hutchins, as manufacturers representative in the Detroit area. Mr. Wilson has been engaged in manufacturers sales activities with the company since 1925, after his graduation from Princeton University, except for his service as manager of the war products division of the company during the war

Russell A. Firestone, son of the late founder and an executive in the Firestone organization, recently completed 25 years with the company and received his pin from his brother, the company president,

Harvey S. Firestone, Jr.

The Timken Roller Bearing Co., Canton 6, has announced the retirement of Harry Y. McCool, Sr., as superintendent of maintenance of the steel and tube division and the appointment of Leland S. Steiner as his successor. Mr. McCool joined Timken in October, 1915, was pro moted to tube mill superintendent in 1920 and to superintendent of maintenance in 1938. Mr. Steiner started with the company in June, 1925, in the electrical department of the steel and tube division and was promoted to superintendent of the department on July 19, 1938. He became assistant superintendent of maintenance on February 16, 1945.

The Faultless Rubber Co., Ashland, held its annual stockholder's meeting September 26 at which all directors were reelected. At the board meeting immediately following the shareholders' meeting, the following officers were elected: Wallace De-Laney, chairman of the board and president; T. W. Miller, Ir., first vice president; George A. Meiler, secretary-treasurer; Z. T. Wile, assistant treasurer; R. C. Johnson and R. D. Stockdale, assistant secretaries.

B. F. Goodrich Chemical Co., Bldg., Cleveland 15, has retained Ernesto Del Valle, of Mexico City, as exclusive sales agent in the Republic of Mexico for all the company's products. Robert P. Kenney, manager of the international sales department of the chemical company, consummated the contract with Senor Del Valle, who will handle the sale in Mexico of Geon polyvinyl resins and plastics, Hycar rubber, Kriston thermosetting resins, and the company's entire line of Good-rite rubber and organic chemicals. Senor Del Valle also will be available for consultation and techservice on all Goodrich Chemical

Pharis Tire & Rubber Co., Newark, has appointed Wm. S. Rowley manager of the Columbus Service Store; he has been on the sales staff since February. He had previously also been employed by Pharis from 1930 to 1937.

Furber Marshall, Pharis president, will address the Society for the Advancement of Management in Dayton on October 19.

Goodyear Report Given at Sales Conference

Interviews to the press were given by J. Thomas and R. S. Wilson, president and vice president, respectively, of Good-vear Tire & Rubber Co., Akron, on September 3 during a conference of the comp any's eastern sales personnel at the Hotel Plaza, New York, N. Y., during which Goodyear's new Super Cushion tire was unveiled for the first time. In reply to questions, Mr. Wilson stated that the Super Cushion size of 70.15 tire would east per Cushion size 6.70-15 tire would cost about 12.5% more than the standard 6.00-16 which it replaces. The Super Cushion is at present being made only in the Deluxe grade, but would eventually be made with nylon cord in the Double Eagle grade, Mr. Wilson added. All automobile manufacturers have expressed the desire to use the Super Cushion tire as new equipment, and Mr. Thomas was confident that the new tire would eventually completely re-

place the present type.

Speaking on the tire outlook, Mr.
Thomas said that current industry-wide tire production was at the 100,000,000-level, but because of some falling off during the last quarter, total tire production in 1947 will probably be about 93,000,000, a new high. This would compare with a production of 82,000,000 tires in 1946 and 64,000-000 in 1941. Of these totals, approximately one-quarter is new equipment, and three-quarters are replacement tires. Mr. Thomas said that tire production would continue high in 1948, estimating that tires would be needed for 4,000,000 new passenger cars and 1,000,000 trucks. He noted that there has been some improvement in production per man-hours of work in the industry. Exports of rubber products have begun to fall off, Mr. Thomas said, presaging a return to more normal competitive conditions In response to a question on the effect of the recent steel price increases, Mr. Thomas said that this might cause a corresponding increase in Goodyear prices. However, despite any national economic difficulties, the tire industry can look forward to a consistent demand for 45,000,000 tires annually for renewal purposes.

Mr. Wilson stated that 55% of all Good-

year tires are sold by independent dealers, and the company operates only 400 retail stores, as compared with 625 stores before the war. These stores are placed only in areas where adequate dealer representation cannot be obtained. Further reduction in the number of Goodyear stores will take place, Mr. Wilson revealed, although a minimum number will be retained indefinitely to provide first-hand merchandising

information.

Discussing Goodyear plans for expansion, Mr. Thomas explained that the recent purchase of Plant C in Akron would provide facilities to triple the present productions of Pliofilm and Airfoam. Thomas foresaw expanded use of Airfoam for car seats and other upholstery, but stated that the use of this material in mattresses would probably be limited to the high priced field. As for the Wingfoot homes, Mr. Thomas said that production was now at the rate of 30 homes a day, and several thousand units have already been built. The most serious problem to date has been the lack of FHA financing for the homes, Mr. Thomas de-clared, but this question is now under government study.

Goodyear now has 72,000 employes, which 55,000 are in this country, Mr. Thomas also reported. This figure compares with the company's wartime peak of 126,000 employes. As for the Goodyear plantations, those in the Philippines are operating normally, Mr. Thomas said, but those in Sumatra have not as yet been inspected by company representatives be-cause of political unrest in that country. Questioned about Goodyear inventories and purchasing policies for natural rubber, Mr. Thomas stated that the company is the Mr. Thomas stated that the company was 'playing it close to the vest," and was not at liberty to divulge any further particulars.

A similar sales conference was held on September 5 at the Hotel Gibson, Cincinnati, attended by about 200 reprensenta-tives from 10 states. Other such conferences were held throughout the nation during September, including Dallas, Houston,

San Antonio, and Los Angeles.

Louis W. Rasor has been appointed district sales manager of Goodyear's mechanical goods division, at Charlotte, N. C. The district embraces North and South Caro-lina and parts of Virginia and West Vir-ginia. Mr. Rasor succeeds Richard G. Ab-bott, now district manager at Los Angeles

after having held the Charlotte post since the district was established in 1945.

Mr. Rasor has been with Goodyear since 1928, starting in the Cincinnati branch office. Later he held safes posts in Detroit and Paducah, Ky., and in 1941 was made mechanical goods representation in made mechanical goods representative in

Toledo, O.

Mr. Abbott has 20 years' service with the company. He spent five years with Goodycar airship operations during the building of the large dirigibles, Akron and Macon. In 1934 he joined the mechanical goods division, first working in belting sales. Two years later he became field representative at Richmond, Va., the post he held until his appointment as manager of the Charlotte district.

Important organizational assignments were announced last month by C. P. Joslyn, general manager of the chemical products division, to handle rapidly expanding ucts division, to handle rapidly expanding sales activities of the company's newest division. E. E. Ellies has been named assistant general manager of the division reporting to Mr. Joslyn. Mr Ellies, who has been with the company 17 years, will devote his full time to handling administration of the division.

devote his full time to handling administrative duties of the division.

Robert C. Hogan, of the aviation products division at Los Angeles, where he had been employed by Goodyear since 1933, has been transferred to Akron as manager of the Airfoam department. W. E. Weller, operating manager of the Airfoam department. ment and with Goodyear since 1938, mostly at Aircraft, has been elevated to a similar post for the entire chemical products division, reporting to Mr. Ellies. J. A. Bernel, a Goodyear employe since 1934, has been named assistant manager of the Airfoam department, reporting to Mr. Hogan.

At the New York meeting Vice President Wilson received his 35-year service pin from President Thomas.

Recent recipient of a 30-year pin was Frank T. Magennis, vice president of Goodyear Export Co.

Among other veteran employes who Among other veteral employes who carned their service pins recently are: 30 years: P. R. Lawson, district store supervisor in Indianapolis; G. E. Glaser, field representative in New York; G. C. field representative in New York; G. C. Lohman, store manager at El Paso; J. J. Haslam, salesman at Saginaw; Leonard Newman, field representative at Mason City; H. B. Ashley, field representative at Indianapolis; 35 years: J. T. Kearny, Sr., district service representative in Sacra-mento; C. A. Gray, branch manager at Birmingham; J. S. Walden, district credit manager in San Antonio.

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The rubber that seals precision switches is vital to the success of many electrical operations.

An excellent example of a control mechanism that requires a high-quality seal for dependable operation under a wide variety of operating conditions is the Die Cast Enclosed Switch produced by MICRO SWITCH DIVISION OF FIRST INDUSTRIAL CORPORATION. This switch is widely used for safety, limit and other control applications on machine tools and industrial equipment. It features ruggedness, light weight, compactness, high electrical capacity, reliability, ease of mounting and long operation life.

Function of the seal is to keep out moisture, dirt, oil and dust. The effectiveness of the seal in performing this

function determines the reliability of operation of the switch. That's why "Micro" engineers, working with the rubber technologists of Acushnet Process Company, selected Perbunan as the logical material for this sealing application.

Both by test and by use Perbunan proves its exceptional ability to resist deterioration from abrasion, heat or cold, oil or water. And a new stabilizer has been added that keeps even delicate color shades constant...with no discoloration of the fluids or materials it contacts.

If you write to our nearest address, our experts will gladly assist on *any* rubber problem you have.



ENJAY COMPANY, INC., 15 West 51st Street, New York 19. N. Y.; First Central Tower, 106 South Main Street, Akron 8, Ohio; 221 North LaSalle Street, Chicago 1, Illinois; 378 Stuart Street, Boston 17, Massachusetts. West Coast Representatives: H. M. Royal Inc., 4814 Loma Vista Avenue, Los Angeles 11, California. Warehouse stocks in Elizabeth, New Jersey; Los Angeles, California; Chicago, Illinois; Akron, Ohio; and Baton Rouge, Louisiana.

THE RUBBER THAT RESISTS OIL, COLD, HEAT AND TIME

Plant engineers and other users can now buy open-end V-belting by the foot or yard in much the same manner as their wives purchase ribbon and dry goods. This method of merchandising V-belt material was announced by Goodyear, which is supplying the belting in reels of 450- to 550-foot lengths, according to H. D. Foster, manager of the mechanical goods division. Using special fasteners to splice the open ends, making an endless power transmission belt, the V-belts can thus be formed to proper size for emergency us; and special adaptations. The fasteners are installed with specially designed tools. Joseph F. Taylor, manager of V-belt sales for Goodyear, predicted several specialized uses for this type of belting, including Diesel locomotives, railroad axle generator drives, air conditioning equipment, air compressors, machine tools, and on line shafts and other drives where it is difficult or impossible to use endless belts. Mr. Taylor also pointed out that the belting would enable farmers to make spot repairs and adjustments. On other operations it will facilitate the installation and maintenance of V-belt drives without the necessity of dismantling expensive equipment. year is supplying open-end V-belting in standard top widths of 21/32-inch,7%-inch, and 1¼-inches. The belt carcass consists of multiple layers of heavy, cross-woven fabric designed for high-power capacity and fastener-holding security. The protective cover was specially developed for maximum flexibility and external wear.

NEW ENGLAND

Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass., through General Sales Manager Owen J. Brown, Jr., has announced that prevailing prices on ordinary rubber grades of channel and furnace blacks will be maintained during the fourth quarter of this year. Mr. Brown pointed out that this announcement is similar to that made by Cabot in June for the third quarter of 1947. The price of natural gas from which carbon black is made continues to rise, and new gas contracts call for increases to become effective on the first of the year. Until the effect of accumulated cost increases have been analyzed, Cabot will take no position in re-spect to prices for 1948. Thomas D. Cabot, company vice president, gave the opinion that no reasonable price adjustment at this time would be effective in bringing out a much needed additional supply channel black and expressed considerable satisfaction in being able to hold the price line for another three months.

The Cabot company, however, later an

nounced a reduction of 1/2¢ a gallon in the price of Southland pine tar and pine tar oil. The lower quotation is for both carload and less carload quantities.

Archer Rubber Co., Milford, Mass., manufacturer of the Royal Archer complete line of rubberized clothing for actual sportsmen, this year is celebrating its fortieth anniversary.

Respro, Inc., 540 Wellington Ave., Cranston, R. L., will erect an addition to its plant at a cost of \$14,500.

White Sidewall Tires Available In Canada

Production of white sidewall tires in popular passenger-car tire sizes began September 2 at the Dominion tire factory of at the Dominion tire factory of Dominion Rubber Co. Ltd., in Kitchener, Ont. The first of these tires will be available through Dominion Royal Tire dealers across Canada, but quantities will be limited for a while.

"Production of Dominion Royal tires with white sidewalls was suspended six years ago," said J. A. Lucas, general sales manager of the company's tire division, 'and since that time this company has delayed their return until a tire could be produced with a larger natural rubber con-

OBITUARY



H. Stuart Hotchkiss

THE American rubber industry has, for the third time in its history, lost from same family a prominent pioneer and expert who has played a conspicuous role in the development of the industry. H. Stuart Hotchkiss, son and grandson of well-known rubber executives of other eras, died September 16 after being stricken with a heart attack at his home in Boston, Mass. He was chairman of the board of General Latex & Chemical Corp. and of Cambridge Rubber Co., both in Cambridge, Mass.

Born in 1878 in the city founded by his ancestors, New Haven, Conn., Mr. Hotch-kiss was educated at Taft School, Phillips Academy, Andover, and Yale University, graduating from Sheffield Scientific School in 1900. A year later he began his asso-

ciation with the rubber industry.

The name of Hotchkiss first entered the rubber industry in the early 1840's when Henry Hotchkiss, grandfather of H. Stuart, became one of the founders of L. Candee & Co. Henry Lucius, son of Henry, took over the position of treasurer and president upon his father's death. This was the firm which H. Stuart Hotchkiss entered when he completed his schooling. He later became secretary, treasurer, and vice president of this same company, now a subsidiary of United States Rubber

In 1914, Mr. Hotchkiss was elected vice

president of General Rubber Co., in 1917, president, and in 1928 chairman of the board. He was president of United States Rubber Plantations, Inc., from 1919 to 1930, and during that time he was also elected to the vice presidency of U. S. Rubber, to the presidency of Naugatuck Chemical Co., and to the chairmanship of the committee on rubber, U. S. Council National Defense.

Mr. Hotchkiss' career was interrupted in October, 1917, when he accepted a commission as captain in the Signal Corps, Later he served as assistant chief of in-spection, equipment division; as senior as-sistant military attaché, American Em-bassy, London; chief of ray material production, Bureau of Aircraft Production; and as vice representative of the United States War Trade Board.

Mr. Hotchkiss devoted much of his time to the development of rubber plantations in Sumatra and the Malay Peninsula and made frequent trips to these areas. intimate knowledge of every branch of the rubber industry made him an able chair-man of the R. A. A. committee, where he was instrumental in drafting the first uniform crude rubber contract to protect importer, manufacturer, and dealer.

The deceased was also a member of the

board of management of the United States government synthetic rubber plant at Baytown, Tex., a director and executive com-mittee member of Union & New Haven Trust Co., and a representative in Europe of the trustees in bankruptcy of the International Match Co. in 1932-33. In 1937 he became president of the Cambridge Rubber Co., and in 1939 chairman of the board of the Vultex Chemical Co.

Mr. Hotchkiss was a 32nd degree Mason; a trustee of the Bermuda Biological Station for Research; a fellow, Silli-man College, Yale; a member of the American Council, Institute of Pacific Relations; vice president of the American Geographic Society; chairman of the council, Mayflower Society; a member of the Society of Colonial Wars, Delta Psi and St. Anthony's Club of New York; and a fellow of the Royal Geographic Society.

Funeral services were held on September 20 at Dwight Memorial Chapel, Yale University, followed by burial in the Grove Street Cemetery, New Haven. He is survived by his wife, a daughter,

and three sons.

Sir Harold Kenward

NEWS has been received of the sudden death of Sir Harold Kenward. Dunlop executive, aboard the Queen Elizabeth en route to the United States and scheduled to land on September 1. Si: Harold, who was director of distribution for the Dunlop Rubber Co. and vice chairman of the Irish Dunlop Co., Ltd., was on his way to visit Dunlop factories in Buffalo, N. Y. Toronto, Canada.

Born in Sussex in 1894, he joined the Dunlop organization in 1911 and his association with this firm continued unbroken, except for the period during 1914-1919 when he served in the Royal Field Artillery. Throughout the recent war he was president of the Tire Manufacturers' Conference, and it was largely due to his efforts that the supply of tires and other equipment to the armed and civilian services, and the rationing of tires. could be successfully organized and a tire famine could be prevented during the rubber crisis which followed the fall of Malaya. Under his direction the tire conference was able to supply 80 million tires for the war.

Accelerators
Plasticizers
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A Complete Line of Approved

Compounding Materials



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l be nine risis ider able war.

It was for these achievements that he was knighted in the New Year Honors 1947. In 1946, as a tribute to the performance of tire manufacturers during the rubber crisis, he had already been honored by being elected president of the Society of Motor Manufacturers and Traders. Sir Harold also served as member of

the Government Rubber Consultative Committee, as a council member of the Federation of British Industries, and as war chairman of 165 Squadron, Air Training Corps. He was a Fellow of the Institute of the Rubber Industry and vice president of the Federation of British Rubber Manufacturers' Association.

He leaves his wife and two daughters. His only son, an officer in No. 3 Com-mando, was killed in the Dieppe Raid in

Sir Harold was buried at sea on his fifty-third birthday.

Frank Zerillo

F RANK ZERILLO, head of Zerillo's Rubber Products, 300 Sheffield Ave., Brooklyn, N. Y., died on August 13. He was 60 years old when he suffered a fatal heart attack in a Brooklyn hospital.

A native New Yorker, Mr Zerillo at-

tended local schools. Typical of his pro-fessional perserverance, he obtained higher education and technical training by going to school in the evening and by educating himself. Before 1931, at which time he developed a process of adhering rubber to metal which was the start of a continuous interest in the rubber industry, he was president of Universal Steel Corp., New York, N. Y., from 1915 to 1920. From 1921 to 1926 he was road construction contractor for the State of New York and from 1926 to 1930 he was a manufacturing chemist. From 1931 on, however, he devoted his entire efforts to the further development of his rubber adhering pro-

In 1944 tests were made at the U. Navy Underwater Sound Laboratory, New London, Conn., under the direction of Columbia University, Division of War Research, which substantiated his claims for his bonding method. Mr. Zerillo's family will continue to develop and expand his process and remain in charge of Zerillo's Rubber Products.

Requiem Mass was sung at St. Jerome' Church, Brooklyn, and burial was in Holy Cross Cemetery on August 16.

Mr. Zerillo is survived by his wife, a son, a daughter, a brother, and a sister.

Harry R. Russon

HARRY R. RUSSON, former manager of link mat sales for Goodyear Tire & Rubber Co., Akron, O., who had been retired on pension since January. 1939, died September 22 in St. Petersburg, Fla., where he had lived for several years. Mr. Russon served Goodyear as salesman in Columbus, in 1911, and as district man-ager in Dayton, O., in 1914; in the company's manufacturers sales organization in 1918; and later in the truck tire department. Then in 1921 he was made manager of the stock clearance department and in

1937 was placed in charge of mat sales. Funeral services were held in St. Petersburg on September 25. Burial was at Bay Pines Veterans Home.

Mr. Russon was married and had one daughter.

Robert P. Hassler

48-YEAR association with the rubber A 48-YEAR association with the industry was ended on August 6 for industry was ended on August 6 for Robert P. Hassler, production superintendent of the mechanical goods division of the General Tire & Rubber Co., Akron, O., when he died at his home in Wabash, Ind.. coronory occlusion.

Mr. Hassler was born on July 15, 1881, in Akron where he later attended Central High School and Hammel's Business College. At the age of 17, in 1899, he took an office boy job with The B. F. Goodrich Co., Akron. He worked his way up to the position of manager of several departments. Then in 1926 he established the extruded and lathe division for Miller Rubber Co., a subsidiary of Goodrich, ments. where he spent seven years. In 1933 he joined General Tire in Akron and de-veloped the mechanical goods division; then, four years later, he went to Wabash to establish the mechanical goods division.

He belonged to Akron Lodge 83, F. & A. M., Washington Chapter 25 and Council 80, West Congregational Church, and the Chamber of Commerce; he was also a past president of Community Service.

Funeral services were held in Wabash August 8, and burial was at the Rose Hill Cemetery, Akron, on August 9.

Surviving are the widow, a daughter. and two grandsons.

Walter P. Bradley

WALTER PARKE BRADLEY, form-er research chemist of United States Rubber Co. and a past president of Bradstone Rubber Co., Woodbine, N. J., died stone Rubber Co., Woodbine, N. J., died September 14, after a long illness, at Southampton, L. I., where he had his sum-

The deceased was born in Lee, Mass., 85 ears ago. He received his A.B. from Williams College in 1884; then he spent four years at the University of Gottingen in Germany, taking A.M. and Ph.D. de-grees. In 1893 he became a member of the faculty of Wesleyan University and continued teaching there as head of the department of chemistry until 1914, when he joined U. S. Rubber. In 1912, however, he had obtained a year's leave of absence from Wesleyan to organize a research defor the rubber company and to partment become director of chemical experiments and investigations at its general laboratories. Dr. Bradley served as a research chemist at U. S. Rubber until he resigned in 1919 to become president of Bradstone Rubber, a position he held until 1938.

Dr. Bradley, director of the first Ameri-



Eriez Permanently Magnetized Pulley Separates Metal Contaminants from Non-Metallic Materials

can laboratory designed for research at extreme low temperatures, was also credited with the construction of the first liquid air machine in the United States and was the author of numerous scientific articles devoted to permanent gases, critical tem-peratures, and similar topics. He belonged to Phi Beta Kappa, Zeta Psi, and Sigma

He is survived by his wife and their daughter.

F. G. Sherbondy

F. G. SHERBONDY, vice president and treasurer of The Biggs Boiler Works Co., Akron, O., passed away on September 11 at a hospital in that city after a year's lingering illness. He had been associated with Biggs 45 years.

Magnetic Pulley

A SELF-ENERGIZED magnetic pulley requiring no electric current to generate a magnetic field is adaptable to all chemical applications requiring automatic separation of magnetic from non-magnetic materials conveyed on a belt. Eriez per-manently magnetized pulleys are being used on receiving belts to remove tramp iron from bulk chemicals and coal. Installed ahead of crushers, spinnerettes, grinders, cutters, and pulverizers these self-cleaning pulleys eliminate machinery damage and explosion caused by stray particles of metal, it is claimed.

The pulley has opened new possibilities toward easier removal of fine ferrous particles from resins, carbon black, abrasives, clay, etc. Many chemical plants are installing this safeguard against metal contamination ahead of packaging equipment. The unit will work effectively through belts of rubber, canvas, leather, or any other non-magnetic materials, thereby performing automatic separation. Field tests in the rubber, mining, and other chemical applications are reported to have shown the pulleys to be thoroughly effective.

Powered by Eriez Alnico alloy magnets. the pulleys have in many cases been placed in hazardous locations where possible sparking has precluded the use of electrically powered magnetic separators. Since moisture, heat, or cold does not affect their operating efficiency, the pulleys may be installed in any location regardless of the elements or operating conditions involved. The permanent magnetic strength is not affected by electric current variations so that the pulley always operates at top efficiency and requires almost no mainte-nance. Eriez Mfg. Co.

Trade Lists Available

The Commercial Intelligence Division of the United States Department of Commerce recently compiled the following trade lists, of which mimeographed copies may be obtained by American firms from this Division and from Department of Commerce field offices. The price is \$1 a list for each country.

Aircraft and Aeronautical Supply and Equipment Importers and Dealers—Costa Rica; El Salvador.

ment Importers and Dealers—Costa Rica; El Salvador.
Boot and Shoe Manufacturers—Nicaragua; Egypt and Cyprus: Greece; Trinidad.
Chemical Importers and Dealers—Guadeloupe: Netherlands; Austria; Ceylon.
Electrical Supply and Equipment Importers and Dealers—Canada.
Machinery Importers and Distributers—Iraq; Mozambique; Peru: Martinique.
Sporting Goods, Toy, and Game Importers and Dealers—El Salvador.

महाप्राः द्या

"LIFE IS NOT ALL BEER AND SKITTLES", FOLKS HAVE SAID
FOR HUNDREDS OF YEARS. BUT "SKITTLES" IS
NOT SOMETHING TO EAT AS MOST HAVE THOUGHT
...IT'S THE WORLD'S OLDEST BOWLING GAME.
FIRST PLAYED BY EARLIEST GERMANIC TRIBES,
SKITTLING IS STILL A WEEKLY SPORT

IN SOME ENGLISH VILLAGES.

SKITTLERS THROW A WOODEN "CHEESE"
THROUGH THE AIR TO HIT NINE PINS.

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DURING THE LAST YEAR, TOTAL

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WERE ENOUGH TO FULLY LOAD
A TANK CAR TRAIN 711/2 MILES LONG!

Hundreds of industries look to Esso Marketers for constant uniformity and suitability of solvents . . . and for friendly, dependable advice. Esso welcomes opportunities to assist with industrial solvents problems.

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Philadelphia, Pa.

COLONIAL BEACON OIL COMPANY

Boston, Mass. - New York, N. Y.

Patents and Trade Marks

APPLICATION

United States

2,424,597. Inflatable Device. J.

2.424,597, Inharable Device, J. A. Werry, Cedar Grove Township, N. J., assignor to Kidde Mfg, Co., Inc., a corporation of Del. 2.424,668. Tire Tread Construction Includ-ing Endless Trend Strips Separated by Endless Zig-zag Grooves, E. E. French, Denver, Colo., assignor to H. V. James, R. Turner, and H. Dutro, as trustees for O. K. Rubber Welding System, a common law trust.

stem, a common-law trust. 2,424,629. Nursing Nipple. W. M. Patterson

2.424,629. Nursing sayar.
Ravenna, assignor of one-half to F. v.
Patterson, Coshocton, both in O.
2.424,701. Leakproof Fuel Tank Including
a Liner of Self-Scaling Material, Enclosed in a
Shell Composed of a Rigid Sheet of a Mixture
of Rubber and Cyclized Rubber, J. A. Merrill,
Barberton, assignor to Wingfoot Corp., Akron,

2,424,777. Laminated Elastic Material for Footwear, E. A. Stuart, Wakefield, assignor to A. Stuart, W riancy Cate Co., Inc., Everett, both in Mass. 2,424,802. Valve Stem Including a Molded Rubber Base and a Rubber Stem. J. C. Crow-ley, Cleveland Heights, assignor to Dill Mfg. Cleveland

nd, both in O.

Pivotal Joint Including an Inner

ambre Enveloped in a One-Piece

2,424,914. Pivotal Joint Including an Inner Bushing of Resilient Material Having a Lubricated Fabric Lining in Contact with the Spherical Member, and a Housing Euclosing the Bushing, R. W. Brown, assignor to Firestone Tire & Rubber Co., both of Akron, O. 2,424,916. Base Plate for Frogs and Crossings Including a Pair of Metal Plates and Layers of Resilient Material between Them and on Top and Bottom of the Composite Structure, T. W. Stedman, New York, N. Y. assignor to Firestone Tire & Rubber Co., Akron, O.

assignor to Frestone Akron, O. 2,424,918. Tubeless Tre and Rim, R. W. Brown, assignor to Firestone Tire & Rubber Co., both of Akron, O. 2,424,923. Fibrous Laminate Including a 2,424,923. Fibrons Laminate Including a Fibrons Web Impregnated and Coated with a Plurality of Binding Material Coatings, In-cluding Uren-Formaldelyde Resin Coatings and a Coating of Butadiene-Styrene Copoly-mer, K. L. Edgar, Cuyahoga Falls, and F. W. Stavely, Akron, both in O., and C. K. Novot-ny, Des Moines, Iowa, assignors to Firestone Tire & Rubber Co., Akron, O.

& Rubber 25,104. TI 2,425,104. Threaded Locking Device in Which an Elastic, Non-Metallic Moldable Ele-ment Effects the Locking Action, R. W. Luce,

Rubber Bushed Tie Rod Joint. A. venditty, Detroit, Mich., assignor to Thompson Products, Inc., a corporation of O. 2.425,298. Bootee with a Thin, Flexible, Elastically Stretchy Upper and a Snug Elasti-cally Stretchy Form Fitting Poot Portion. A. E. Shaffer, assignor to Mishawaka Rubber & Woolen Mfg. Co., both of Mishawaka, Ind. 2.425,237. In Extrusion Apparatus of the Type Wheepin Ergements of Matagial Are A. E. Shafter, assignor to Mishawana and M. & Woolen Mfg. Co., both of Mishawaka, Ind. 2,425,237. In Extrusion Apparatus of the Type Wherein Fragments of Material Are Compacted into a Solid Mass by Being Forced through a Rigid Nozzle, an Auxiliary Nozzle Including a Metal Framework to Which Is Vulcanized a Rubber Conduit Provided with Treads Which Can Be Made, by Pneumatic Means, to Exert a Resisting Force on the Mass as It Passes through the Conduit. C. Field, assignor to Flakice Corp., both of Brooklyn, N. Y.

2,425,349. Laminated Structure Including Rubbery Polymer and a Textile Material A hered to Each Other by a Blend of Cyclized Rubber, Phenol, and Resol, H. S Schroeder, assignor to E. L. du Pont Cyclized Kubber, Flexible Compression of the Compression of the Compression of the Compression of the Compressors, Including Plastic and Relatively Rigid, Non-Conducting Bushings, J. Touborg,

and Relatively and Relatively consent, Mich.

2,425,422. In Electrical Apparatus for Sterilizing Catgut, a Receptacle of Glass or Like Material in the Form of an Open-End Tubular Member With a Removable Bottom of Material Such as Rubber, L. Arnanz, Vind.

2,425,479. Fib. Spain 2,425,479. Fib. Spain 2,425,479.

Tallada, Barcelona, Spain.

2,425,479. Elastic, Endless Garter Having a
Lower Portion to Engage a Garmet and an
Upper Portion Engaging the Limb of the
Wearer; the Upper Portion only is Provided
with Adhesive on its Inner Surface, E. V. Le
Blane, Arlington, Mass.

Blanc, Arlington, Mass. 2,425,483. A Pipe Line Stopper Insertable through a Side Wall Opening in a Main; the Stopper Includes an Elongated Body Sur-rounded by a Rubber Sleeve Which Can Be Made to Conform to the Opposite Inner Walis of the Main by Means in the Body, F. H. Mueller, Hot Springs, National Park, Ark.,

and J. J. Smith, assignors to Mueller Co., both in Decatur, Ill. 2,425,514. Self-Sealing Fuel Tank, P. J. Dasher, Stow, R. A. Crawford, Akron, and R. S. Colley, Kent, all in O., assignors to B. F. Goodrich Co., New York, N. Y. 2,425,575. Drive or Conveyer Belt Including a Body Portion of Rubber Material, Longitudinally Intending Load-Carrying Layer of Flexible Steel Cables Embedded in the Body Portion, Textile Cords at the Edges of the Layer of Steel Cables, and Transversely Excending Fabric Weft Cords Tying together the Layer of Cables and Longitudinally Extending Cords. P. D. Suloff, assignor to Wingfoot Corp., both of Akron, O. Cords. P. 15,

Corp., both of Akron, O.
2,425,399. Flexible, Rubber-Like Jacket for
Liquid Cooling of Glass Tubes. I. W. Cox.
West Allis, assignor to Cutler-Hammer, Inc.,
Milwaukee, both in Wis.
2,425,662. Flexible Coupling. J. N. Wol-

2,425,662. Flexible Coupling. J. N. worfram, assignor to Parker Appliance Co., both of Cleveland, O.
2,425,683. Lunch Bag Including a Body Formed from a Single Piece of Waterproofed Fabric, E. L. Martin, Dunbar, Pa.
2,425,707. Shank Stiffener for Shoes, Including Extruded Plastic Material Having a Flexual Strength of at Least 5,000 Pounds per Square Inch. F. P. Wagner, Normandy, assignor to Brauer Brothers Shoe Co., St. Louis, both in Mo.
2,425,728. In a Mattress, the Combination of an Inner Spring Unit and Soft Rubber Caps Fitting over the Unit. T. S. Cobb, Fort Lauderdale, Fla.
2,425,841. For Fluid Containing Receptand

Fitting over the Unit. T. S. Cobb, Fort Lauderdale, Fla. 2,425,841. For Fluid Containing Recepta-cles, a Removable Closure, Including an Interiorly Hollow Body Made of a Resilient Flexible Pressure-Deformable Material, A. L. Scott, Columbus. O

6. Mechanized Landing Strip In-Rotatably Mounted and Parallel d Shafts Equipped with Resilient neels, S. S. Knox, Long Beach, Calif. Horizontal Shafts Equipped with Resilient Tired Wheels, S. S. Knox, Long Beach, Calif. 2,426,047. In a Fluid Seal, a Sealing Mem-ber of Rubber Having an End Portion Fitting Tightly on a Shaft, a Flange Portion Extend-ing therefrom, a Contact Extremity at the Other End Joined by Resilient Bellows-Like Folds, F. E. Payne, Glencoe, assignor to Crane

Folds, F. E. Payne, Glencoe, assignor to Packing Co., Chicago, both in 111. 2,425,658. Ribbed and Laminated Plastic Sheet Material Including Outer Layers of Plastic Impregnated Sheet Material, an Intermediate Layer of Plastic Impregnated Sheet with Slits therein through Which Deformable Cores Are Threaded, C. A. Scogland, assignor to the Studebaker Corp., both of South Bend,

2,426,174. In a Fluid Sealing Device fo Rotating Parts a Member of Rubber-Lik Material Radially Disposed between the Parts Having a Sealing Surface on One Side and Projections on the Opposite Side, F. Bottom-ley, Barrington, R. I., assignor to Sealol

operions on the Opposite Side, F. Bottom-r, Barrington, R. I., assignor to Scalol orp., a corporation of R. I. 2,426,211. For Rubber Safety Footwear, a de Structure including Outer Sole and Heel Synthetic Rubber with a Non-Skid Tread, d Layers of Felt between Which Is a exible Steel Plate E. F. Heckman, United Flexible

2.426,227. Spinning Cot with a Body of terylic Nitrile and Butadiene Copolymer an articles of Cellulose Sponge Dispersed therefore, E. L. Luaces, assignor to Dispersed Particular through, E.

Rubber Mfg. Co., both of Dayton, O. 2,426,281. In a Head and Nasal Clarifler Including a Nozzle, a Tubular Extension for the Nozzle, and a Plunger, an Elastic Air-Bulb Connected with the Nozzle and Surrounding Tubular Extension and Plunger, G. W. Oakes, Rochester, Pa.

Dominion of Canada

443,025. A Model Airplane Body Formed f Strong Airtight Material and in the Body Collapsible Container Adapted to Contain Fluid or Gas under Pressure, N. J. Walsh.

Montreal, P. Q.
443,027. In an Auger Conveyer for Grain
Harvesters Having a Helical Blade Running
in an Open Topped Conveyer Box, a Wiping
Blade of Heavy Duty Rubber Secured to the
Peripheral Part of the Auger Blade, A. R.
Where Standard (2016). I. S.

Peripheral Part of the Auger Blade, A. R. Wheat, Stockton, Calif., U. S. A. 443,053. A Rubber Belt Including Tension, Neutral Axis, and Compression Sections, a Breaker Strip Surrounding These Sections, and at Least One Strand of Wire Wrapped thereover, Dayton Rubber Mfg. Co., assignee of M. A. Crosby, both of Dayton, O., U.S.A. 443 256. Belt Including Tension, Neutral Axis, and Compression Section; the Neutral Axis Section Consists of Wire Cords Embedded in Rubber and Parallel to Each Other along the Longitudinal Axis of the Belt. Each Wire Cord Made up of Fine Strands of

Wire Coated with and Separated from Each Other by a Rubber Composition and Cabled to Form an Integral Article. Dayton Rubber Mfg. Co., assignee of M. A. Crosby and E. Lorenzo-Luaces, all of Dayton, O., U.S.A. 443,357. Wiper for Rearview Mirrors. W. Duchnitski, Buchanan, Sask. 443,399. Lifeboat for Air or Other Craft Including a Watertight, Readily Releasable Container and Inflatable Buoyant Means Attached to and Adapted to Be Housed in Inflated Condition in the Container. B. W. O. Townshend, Croydon, Surrey, England. 443,4413. Screen Structure of Nylon Monoilis.

Committed Condition in the Container. B. W. O. Townshend, Croydon, Surrey, England, 443,413. Screen Structure of Nylon Monofils, Canadian Industries, Ltd., Montreal, P. Q., assignee of L. G. Wise, Wilmington, Del., U.S.A.

43,458. An Are Splitter for Use in Circuit Breakers and Like Devices Subject to Elec-trical Ares, Including a Member Having Elec-trical Insulating Properties and a Mold Sur-face of Substantial Thickness of Melamine-Aldehyde Resin, Canadian Westinghouse Co., Ltd., Hamilton, Ont., assignee of C. F. Hill, Resin, Canadian Westinghouse Co., nilton, Ont., assignee of C. F. Hill, I, and R. W. Auxier, Wilkinsburg,

Aldehyde Resin, Canadian Westinghouse Co., Ltd., Hamilton, Ont., assignee of C. F. Hill, Edgewood, and R. W. Auxier, Wilkinsburg, both in Pa., U.S.A. 443.475. In a Support for Electrical Apparatus Including a Base and a Stud Secured thereto, Rubber-Like Annular Members Mounted on the Base, Canadian Westinghouse Co., Ltd., Hamilton, Ont., assignee of W. Schaelchlin, Wilkinsburg, Pa., U.S.A.

United Kingdom

Oll Seals, Cooper & Co. (Birming-Ltd., and E. P. Stokes.
 Sealed Electric Cable. Carbide &

58. ham), 1. 589,955. on Che

590,167. Molded Products with Reinforcements of Filamentary Material, J. Allan. 590,205. Synthetic Resin Laminates. J. Allan. Brake for an Airplane-Type Land-

ing Wheel. Firestone Tre & Rubber Co. 596,700. Pneumatic Resilient Structures. Lea Bridge Industries, Ltd., and G. Ingram. 590,765. Rubber Shock Absorbing Bushes, Metalastik, Ltd., M. Goldschmidt, and A. J.

Hirst. 590,919. Anti-Vibration Mountings. Clayton-Wright.

PROCESS

United States

2.425,166. Rubber Bugs. T. S. Watson, assignor to Huebsch Mfg. Co., both of Milwaukee, Wis. 2.425,294. Thermoplastic Insulated Multi-Conductor Structures, J. T. Morgan, Charleston W. V.

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2,425,528. Terminal Joint for Plastic-Sheathed Electric Cable, G. Haim and H. P. Zade, assignors to Arc Mfg. Ltd., all of London, England, 2,425,666. In the Producti-

London, England, 2,425,666. In the Production of Shaped Articles by the Polymerization in a Rigid Mold of Organic Compounds, Maintaining the Volume of the Material Constant by Suitable Regulation of Temperature during Polymerization, C. E. Barnes, Belvidere, N. J., assignor to General Aniline & Film Corp., New York,

Dominion of Canada

443,054. Improving the Tensile Strength and Aging Properties of Cotton Cords or Yarns by Mechanically Stretching, Rubberizing, and Drying the Cords or Yarns in Addition to Treating Them with a Water-Soluble Abletic Acid Derivative Containing a Tricyclic Hydroaromatic Condensed Nucleus, Dominion ber Co., Ltd., Montreal, P. Q., a McW. Buckwater, Detroit, Mic assignee

H. McW. Buckwater, Detroit, Mich, 443,297. Forming Laminates of Impregnated Fabric, Shellmar Product Mount Vernon, O., assignee of Swedlo plastic Corp., Glendale Calif., both es of Products

1.88.A. 443,555. Thermoplastic Resin-Exfoliated Vermiculite Composition, Shawinigan Chemicals, Ltd., Montreal, assignee of T. P. G. Shaw, Shawinigan Falls, both in P. Q.

443,732. Bonding Viscose Rayon Filaments to Rubber, Courtaulds, Ltd., London, England, assignee of D. Entwistle, Coventry, Warwick, England.

United Kingdom

590,034. Making Fabric-Reinforced Resins Bars by a Continuous Operation. United

States Rubber Co. 590,042. Working Polyethylene Composi-tions. Bakelite. Ltd. 590,596. Molding Thermoplastic Sheet Ma-Bakelite, Ltd. 96. **Molding Thermoplastic Sheet Ma-**G. W. Borkland.

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Ap-ired bers

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He gives bearings a rub-down to put curves in the right places



... for faster operation, greater accuracy, maximum load capacity

Nthe final manufacturing process, ■ Timken T-type thrust bearings are assembled and processed so that the surfaces of the ribs, rollers and races are generated as a unit. The bearing thus becomes a "Generated Unit Assembly".

This extra process produces a smoothly-curved area of contact between the end of each roller and the cone rib against which it operates, so that the convex shape of the roll end and the concave surface of the cone ribs are identical in contour.

We developed this process years ago for thrust bearings which must operate under extreme loads with high roll and pressures against the cone ribs end since have adapted it to other Timken bearings, including those used for precision machine tools, steel mill and railroad equipment and other applications.

Today "Generated Unit Assembly" reduces friction and wear to the vanishing point; increases load capacity; assures positive roll alignment; eliminates the need of breaking-in or final adjustment on the job; and lengthens bearing life. It is one of the many reasons why it pays to have Timken bearings in every machine you manufacture or buy.

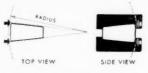
REMEMBER, Timken bearings are produced by the only bearing manufacturer in the country making its own steel and Timken is the acknowledged leader in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels. The Timken Roller Bearing Company, Canton 6, Ohio.

GENERATED UNIT ASSEMBLY



Extra manufacturing process makes Timken heavy duty thrust bearing a "Generated thrust bearing a Unit Assembly".

CURVED AREA RIB CONTACT



Curved area of roll end (at arrows) fits perfectly the curve of upper and lower ribs of this thrust bearing.



ROLLER BEARINGS

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590,689. Extruded Shapes from Organic Thermoplastic Materials, E. I. du Pont de Nemours & Co., Inc. 590,689. Coating Hydrophilic Sheets or Films to Render Them Waterproof, Sylvania

Industrial Corp. 599,875. Electric Cables, R. C. Mildner.

CHEMICAL

United States

2,424,589. In Preparing Beta-Propiolactone, the Steps of First Making a Solution Includ-ing a Friedel-Crafts Catalyst Dissolved in Pre-pared Beta-Propiolactone, and Then Adding Ketene and Formaldehyde, T. R. Steadman, Akron, O., assigner to B. F. Goodrich Co.,

New York, N. Y.

2.424.590. In preparing Beta-Propiolactone
from Ketene and Formaldehyde, the Step of
Carrying out the Reaction at Below 30° C,
in the Presence of a Catalyst Including as an
Essential Ingredient, a Mixture of Aluminum
Chloride and Zine Chloride, T. R. Steadman
and P. L. Breyfogle, both of Akron, O,
assigners to B. F. Goodrich Co., New York,
N. Y.

2.424.545.

N. Y. 2,424,648. Continuously Transforming an Alkaline Soap-Containing Aqueous Dispersion of a Synthetic Rubber into a Sheet, W. F. Bixby, Akron, O., assignor to B. F. Goodrich

Co., New York, N. Y.
2.424.691. Product of the Reaction of Thiophene and a Vinyl Ester from the Group of
Vinyl Acetate and Vinyl Propionate in the
Presence of Boron Trifluoride, R. C. Hansford,
Woodbury, N. J., assignor to Socony-Vacuum
Oil Co., Inc., a corporation of N. Y.

2.424.730 Crew 2010.

Presence of Boron Trifluoride, R. C. Hansford, Woodbury, N. J., assignor to Socony-Vacuum Oil Co., Inc., a corporation of N. Y. 2,424,730. Coating Composition Including a Vehicle Containing Drying-Oil-Modified Alkyd or Phenol-Formaldehyde Resin, Pigment, Litharge, and Calcium Hydrate, L. Balassa, Swarthmore, Pa., assignor to E. I. du Pont de

2,424,736. For Use as a Cement between Rubber-Like Materials and Metal Parts, a Solution Including Natural or Synthetic Rubber and Channel Carbon Black in Excess of the Rubber, S. L. Brams, Dayton, O., as-

signor to General Motors Corp., Detroit, Mich. 2,424,787. Congulated Plastic Product Capable of Being Directly Molded under Heat and Pressure, from a Heat-Convertible One-Stage Phenol Formaldehyde Resin Syrup at Room Temperature, W. H. Adams, Newark, Del., assignor to Haveg Corp., Newark, N. J. 2,424,838. Resin, the Conjoint Polymer of a Mixture of a Monocarboxylic Acid Ester of Allyl Meohol and a Vinyl Ester, E. W. Moffert, Milwankee, Wis., and R. E. Smith, New

Glass Co., a corporation of Pa.
2.424,884, Sulfur Vulcanization of Unsaturated Reaction Products of Diisocyanate with
Linear Polyesters and Linear Polyesteramides
and Products Resulting therefrom, J. G. Cook,
D. A. Harper, R. J. W. Reynolds, and W. F.
Smith, Hackley, Manchester, England, assignors to Imperial Chemical Industries, Ltd.,
a corporation of Gene Riving.

Smith, Blackley, Manchester, England, assignors to Imperial Chemical Industries, Ltd., a corporation of Great Britain, 2,424,885. Compounding Reaction Products of Disseyanate with Linear Polyesters and Linear Polyester-amides, with Paraformaldehyde in the Presence of a Basic Material Which Will Neutralize Acid Present during Compounding, J. M. Buist, D. A. Harper, W. F. Smith, and G. N. Welding, Blackley, Wanchester, England, assignors to Imperial Chemical Industries, Ltd., a corporation of Great Britain.

Great Britain.

2.424,320. Injection of Chlorine for from
Pour to 36 Hours into an Aqueous Suspension
of a Granular Porous Solution-Chlorinated
Rubber, H. E. Albert, Akron, O., and R. J.
Reid, Fair Lawn, N. J., assignors to Firestone
Tire & Rubber Co., Akron, O.

2.424,321. Thiocarbamyl Suffenamides, G. E.
P. Smith, Jr., and E. L. Carr, assignors to
Firestone Tire & Rubber Co., all of Akron,
Ohio.

2,424,951. Mixture of Chemical Compounds Having Pronounced Emulsifying, Dispersing, and Wetting Properties. A. R. Globus, Forest 424.951.

Hills, N. Y.
2,424,979. Polymerization of Rosin by
Treating the Rosin in Liquid Phase with a
Catalyst from the Group of Mercury Chlorides
and Mercury Bromides; the Catalyst is Formed
in situ. B. L. Hampton, Jacksonville, Pla.,
assignor, by mesne assignments, to Glidden
Co. Claysing G.

Co., Cleveland, O. 2,424,996. In Adhesive Tape Including a Hydrophilic Backing and a Hydrophobic Adhesive Mass, as Intermediate Priming Cont of Particles of Hydrophobic Vulcanized Rubber Derived from an Aqueous Dispersion of a Vulcanized Rubber. V. N. Morris, Highland Park, assignor to Industrial Tape Corp., North Brunswick, both in N. J.

Mirror Protective Coating Includ-

ing a Solution of Chlorinated Rubber, a Plasticizer, and Bone Black, J. H. Smith, Vallejo

2,425.045. Oriented Polysulfide Polymers,

J. C. Patrick, Morrisville, Pa., assignor to Thiokol Corp., Trenton, N. J. 2,425,191, Polymerizing an Alkyl Ester o Acrylic Acid in Which the Alkyl Group Con-tains from One to Four Carbon Atoms in an at Least 65% Solution of Zinc Chloride in Water, E. L. Kropa, Fairfield, Conn., assigno Alkyl Ester of Polymerizing Vinyl Acetate in % Solution of Zinc Chloride Kropa, Fairfield, Conn., assig Cyanamid Co., New York, N. at Least 65% Water, E. L. 1

rican Butadiene Compositions Contain ing as Plasticizer Phthalimido-Alkyl Alkano

es, P. F. Tryon, assignor to Commercial devents Corp., both of Terre Haute, Ind. 2,425,338. For Bonding Textile Materials Rubbery Polymers, a Composition Including a Cyclized Natural or Synthetic Rubber d Resortion-Formaldehyde Resol, H. E. hroeder, assignor to E. I. du Pont de mours & Co., Inc., both of Wilmington, Del. 2,425,367. Polynitroparaffins, W. I. Denton, Oodbury, R. B. Bishop, Haddonfield, and M. Nygaard, Woodbury, all in N. J., and T. Noland, Richmond, Ky., assignors to cony-Vacuum Oil Co., Inc., a corporation of Y.

2.425.432. 2-Chloro 2-Cyanobutanes Containing an Additional Chlorine Radical in One of the Positions Adjacent to the 2-Position. J. G. Lichty, Stow, assignor to Wingfoot Corp., 2405.26.

2.425,509, Preparing Dichlorosuccinic Anydride by Treating Molten Maleic Anhydride with Gaseous Chlorine at a Temperature of at Least 140° C, under Pressure, A. M. Clifford and J. R. Long, Stow, assigners

Corp., Akron, both in O.
2.425.597. Light-Colored Sulfurized Products from Starting Materials from the Group of the Unsaturated Fatty Acid Triglycerides. Unsaturated Oil Soluble Thermoplastic Resins, and Mixtures of Them, J. W. Church, Mt. Lebanou, assignor to Falk & Co., Carnegio, both In Pa.
2.425.615. Tertiary Alkoyacetonitrile, W. F. Gresham, assignor to E. I. d Pont de

24.25.015. Ferriary Akoxyacetomitrile, W. F. Gresham, assignor to E. I. d Pont de Nemours & Co. Inc., Wilmington, Del. 2.425.638. Continuous Process for Homopolymerizing Ethylene at a Pressure above at Least 1.000 Atmospheres, M. D. Peterson, Oak Ridge, Tenn., assignor to E. I. du Pont de

Nemours & Co., Inc., Wilmington, Del. 2,425,840. Lower Alkyl Mercaptans as Short Stopping Agents in Butadiene-Styrene Emulsion Polymerization. W. A. Schulze and W. Crouch, both of Bartlesville, Okla., assignors to Phillips Petroleum Co., a corporation of Del.

017. Preparing 1, 3-Butylene Glycol by 2.426.017. Preparing I. 3-Butylene Glycoi by Heating Aqueous Formaldelyde in the Pres-ence of Sulfuric Acid and I. 3-Butylene Glycoi Formal with Propylene, C. H. Hamblet, Gor-don Heights, and A. McAlevy, assignors to E. I. du Pont de Nemours & Co., Inc., both of Millianter, hoth in Ind.

Photochemical Chlorination of 2.426,080. Photochemical Chlorination of Polyvinyl Chloride. J. Chapman, Halewood, and J. W. C. Crawford, Frodsham, both in England, assignors to Imperial Chemical Industries, Ltd., a corporation of Great Britain, 2.426,091. Chlorinated Aliphatic Nitrile, J. J. Gray, Liverpool, and F. Burgess, Wilmes, both in England, assignors to Imperial Chemical Industries, Ltd., a corporation of Great Beltain.

2,126,111. Producing Solid Electrically In-sulating Materials from Polyisobutylene, Sty-rene, and Divinyl Benzene, W. Mertens, Berlin-Zehlendorf, Germany; vested in the Attorney General of the United States.

2,426,121-122. Organo-Silicon Compounds.
B. Rust, West Orange, and C. A. MacKenzi Upper Montclair, both in N. J., assignors t Montclair Research Corp., a corporation of Organo-Silicon Compounds, J.

426.125. Solid Addition Product of Alginic d and an Alkylene Oxide. A. B. Steiner, Jolla, assignor to Kelco Co., San Diego, a in Calif.

Rubber-Like Materials with the Aid of Liquid Refrigerant. R. M. Thomas, Union and D. C. Field, Linden, both in N. J., assign ors, by mesne assignments, to Jasco, Inc., 2,426,128. Coagulating Latices of Synthetic

corporation of La.
2,426,128. Hardening a Composition Including an Organic Binding Material Capable of
Being Hardened by Formaldehyde, by Incorporation of Trimethylolnitromethane, W.
Trowell, Greenville, S. C., assigner to
Hercules Powder Co., Wilmington, Del.

Hercules Powder Co., Wilmington, Det. 2,426,143. Stabilizing Normally Unstable Furfural by Incorporating a Small Proportion of Hydrosulfite. R. L. Comstock, Weeks, La., and H. F. Reeves, Wyandotte, Mich., assignors to Bay Chemical Co., Inc., New Orleans,

2.426.165. Vulcanizate of a Compound In-

cluding Butadiene Styrene Copolymer, Yukcanizing Agent, Paracoumarone Resin, Barium Sulfate, and Zine Sulfate. T. A. Bullfan, Hackensack, N. J., assignor to Allied Chemical & Dyc Corp., New York, N. Y.

2,425,424. Lacquer Including Ethylene Giv.

ical & Dye Corp., New York, N. Y.
2,426,242. Lacquer Including Ethylene Gly.
col Mono-Methyl Ether Acetate, Cellulose
Acetate, and a 5% Solution of Selenium
Dioxide in Ethyl Mchohol. O. Saslaw, Kearny,
N. J., assignor to International Telephone &

Radio MIR. Gorp., New York, N. Y.
2,426,257. Adhesive Composition Including
a Normally Solid Aromatic SulfonamideFormaldehyde Resin, Cellulose Acetate, and a
Non-Volatile Liquid Toluene Sulfonamide
Plasticizer Compatible with Both. P. F.
Ziegler, Winnetka, Ill., assignor to Kendall
Co., Boston, Mass.

Co., Boston, Mass.
2,426,316. Improved Vinyl Acetate-Vinyl
Chloride Copolymer Resin Composition Including in Addition to a Plasticizer, up to 30g
by Weight of the Resin of Factice. F. &
Martin, Providence, R. I., assignor to United
States Rubber Co., New York, N. Y.

Dominion of Canada

442,084. Corrosion-Resistant Coating for Cartridge Cases Including an Alkoxy-Substituted Product and an Extracted Pine Libbey-Owens-Ford Glass Co., assignee of Plaskon Co., Inc., assignee of O. P. Clipper, all of Toledo, O., U.S.A.

all of Toledo, O., U.S.A.

443,090. Diethylene Glycol Bis (Chloro-formate). Pittsburgh Plate Glass Co., Pitts-burgh, Pa., assignee of I. E., Muskat and F., Strain, both of Akron, O. both in the U.S.A.

443,097. Polymerization of Vinyl Ester in Strain, both of Akron, O. both in the U.S.A. Emulsion. Shawingan Chemicals Ltd., Mon-treal, assignee of H. M. Collins, Shawingan Falls, both in P. O.

treal, assig

s, actn in P. Q., 3,098. Polymerization of Vinyl Ester In Islon. Shawinizan Chemicals Ltd., Mon-assignee of M. Kiar, Shawinigan Falls, in P. Q.

note in F. Q.

443,099. Coarse-Grained Suspension of a
Polyvinyl Ester. Shawinigan Chemicals Ltd.,
Montreal, assignee of H. M. Collins, Shawinigan, both in P. Q.

443,124. Molding Composition Including a
Pusible Acid Catalyzed Phenol-Formaldehyde
Condensation Product and a Separately Prepared Fusible Melamine-Formaldehyde Resin.
American Cyanamid Co., New York, N. Y. of F. J. Groten, Stamford, Conn.

443,224. Resinous Composition Including the Product of Substantially Simultaneous Re-action of a Phenol, Aldebyde, and an Ol-from the Group of Tung Oil and Olticica Oil, Stabilized by a Nitrogenous Organic Com-pound, Canadian Westinghouse Co., Ltd., Hamilton Cert. Resinous Composition Including

Stabilized by a Nitrogenous Organic Compound. Canadian Westinghouse Co., Ltd., Hamilton, Ont., assignee of R. W. Auxier, Pittsburgh, and W. C. Weltman, Wilkinsburg, both in Fa., U.S.A. 443,228. Adding Precipitated Gelatinous Hydrous Metal Oxide Particles Containing Adsorbed Water to a Wet Phenol-Addhyde Resin and Then Dehydrating to Obtain a Resinous Composition. Carbide & Carbon Chemicals, Ltd., assignee of Bakelite Corp. of Canada, Ltd., both of Toronto, Ont., assignee of C. Rector, Brooklyn, N. Y., and C. F. Schrimpe, Woodbridge, N. J., both in the U.S.A.

U.S.A.
443,230. For an Abrasive Article, a Hard-ened Binder Including the Additive Reaction Product of Diethylene Glycol Fumarate and a Vinyl Compound. Carborundum Co. Niagara Falls, assignee of N. P. Robie, Lewiston, and O. LeB. Mahlman, Kennore, all in N. Y.

U.S.A.
443,238. Acyclic Condensation Products
Acetylene. Distillers Co., Ltd., Edinbur,
Scotland, assignee of H. P. Staudinger, Ew,
and K. H. W. Tuerck, Banstead, both
Surrey, England.

and K. H. W. Tueres, Balascal, 603.

443.253. Composition Including a Resin of the Vinyl Hallde Type and, as Plastleizer therefor, Dissobutyl Adipate, Glenn L. Martis Co., Middle River, assignee of E. H. Sorg, Hyde, both in Md., U.S.A. 443.295. Reducing the Water Permeability of a Polysulfide-Type Synthetic Rubber Later Film by Exposing It to Contact with a Liquid Hydrocarbon Mixture Containing at Least 5% by Weight of a Benzenold Hydrocarbon. Stoner-Mudge, Inc., assignee of F. R. Stonef, Jr., and W. K. Schneider, all of Pittsburgh, Pa., U.S.A.

Stoner-Mugge, Jr., and W. K. Schneider, an o. Jr., and W. K. Schneider, an o. Jr., and W. K. Schneider, an o. Jr., and Jr., and Jr. an yanamid Co., New York, N. Y., assigned R. Stock, Greenwich, Conn., both in the

U.S.A.
443,414. Synthetic Linear Polyamide Hav-ing Improved Resistance to Degradation.
Canadian Industries, Ltd., Montreal, P. Qo-assignee of G. B. Taylor, Wilmington, Del-

U.S.A.
443,419. Resinous Product of the Reaction,
in the Presence of an Acld Catalyst and 8
Polymerization Inhibiter, of an Acyclic Polyhydric Aliphatic Alcohol and an Aldehyde.
Canadian Inustries, Ltd., Montreal, P. Q.



assignee of H. S. Rothrock, Wilmington, Del., U.S.A. 443,420. Synthetic Lingue Polescott

U.S.A.

443,420. Synthetic Linear Polyamide with
Improved Durability on Exposure to Sunlight.
Canadian Industries, Ltd., Montreal, P. Q.,
assignee of D. D. Coffman and H. B. Stevenson, both of Wilminston, Del., U.S.A.

443,422 Preparing Bubble-Free Solid Bodies
from a Syrup of a Polymer from the Group
of the Esters of Acrylic and Methacrylic
Acids, Dissolved in a Monomer from the
Group of the Esters of Acrylic and Methacrylic Acids. Canadian Industries, Ltd., Montreal, P. Q., assignee of D. H. Beaton, Arlington, N. J., U.S.A.

ton, N. J., U.S.A 443,425. Interpolymers of Trimethyl Al-uminate, Tetramethallyl Stannate, or Tetra-methallyl Titanate with Methyl Methacrylate or Vinyl Acetate, Canadian Industries, Ltd., Montreal, P. Q., assignee of H. S. Rothrock, Wilminston, Del. I'S A

Wilmington, Del., U.S.A.
443,429, Polymeric Hydroxamic Acid, the
Reaction Product of Hydroxylamine with a
Malele Anhydride Interpolymer, Canadian
Industries, Ltd., Montreal, P. Q., assignee of

D. D. Coffman, Wilmington, Del., U.S.A. 443,432. Clear, Colorless Solutions of Acry-lonitrile Polymers. Canadian Industries, Ltd. Montreal, P. Q., assignee of T. G. Finzel, Ken-more, N. Y., U.S.A.

more, N. Y., U.S.A.
443,435, Reducing the Heat Shrinkage of
an Oriented Polyvinyl Chloride Filament.
Canadian Industries, Ltd., Montreal, P. Q.,
assignee of K. L. Berry, Hockessin, and J. W.
Hill, Wilmington, both in Del., U.S.A.
443,437, Solid, Macromolecular, Partially
Hydrolyzed Interpolymer of Ethylene with a
Vinyl Ester of an Organic Monocarboxylic
Acid. Canadian Industries, Ltd., Montreal,
P. Q., assignee of J. R. Roland, Wilmington,
Del., U.S.A.
443,438, Copolymerization Product of a

Del., U.S.A.,
443,438. Copolymerization Product of a
Mixture of a Perhaloethylene Containing at
Least Two Fluorine Atoms, Vinyl Fluoride and
a Hydrogen-Containing Halogenated Ethylene
Other Than the Vinyl Fluoride, Canadian
Relativities Ltd. Montreal P. O. assignment

Mixtus.

Least Two Fluors.

a Hydrogen-Containing Damother Than the Vinyl Fluoride.
Other Than the Vinyl Fluoride.

Industries, Ltd., Montreal, P. Q., assignee of E. L. Martin, Wilmington, Del., U.S.A.
443,501. For Use in Refrigerations, a Light.
Tough Composition Resistant to Deterioration
in Humid Temperatures and Free from Objectionable Odors, Consisting of Cellulose
Aceto-Butyrate and a Substance from the
Group of Vanillin and Coumarin. Canadian
inghouse Co., Ltd., Hamilton, Ont., asVoxsimer, Mansfield, O., U.S.A.

Voxsimer, Mansfield, O., U.S.A.

Westinghouse Co., Laux, Hamsheld, O., U.S.A. signee of O. H. Yoxsimer, Mansfield, O., U.S.A. 443,537. Thermosetting Composition Capable of Being Compounded and Processed Like Natural Rubber Including a Plasticized Polyvinyl Butyral, a Heat Hardening Resin, and Zine Oxide as an Accelerator. Hodgman Rubber Co., assignee of J. L. Haas, both of Framingham, Mass., U.S.A.

Framingham, Mass., U.S.A. 443.552. Preparing a Copolymer by Polymerizing an Ester of a Monounsaturated Monohydric Alcohol and an Unsaturated Monocarboxylic Acid. Interrupting the Process before Formation of an Intsible Gel, Separating the Residual Monomer, Adding Ylayl Acetate and Polymerizing the Mixture. Pittsburgh Plate Glass Co., Pittsburgh, Pa., assignee of I. E. Muskat and F. Strain, both of Akron, O., and M. A. Pollack, Austin, Tex., all in the U.S.A. the U.S.A

in the U.S.A. 443,566. Separating Isoprene from Mixtures with Compounds from the Class of Monolefines and Paraflins Having Vapor Pressures Close to That of Isoprene. Shell Development Co., San Francisco, assignee of T. W. Evans and E. C. Shokal, both of Oakland, and R. C.

Morris, Berkeley, all in Calif., U.S.A. 442,641. As Bond in the Manufacture of an Abrasive Article, an Insoluble Infusible Poly-merized Ester of an Unsaturated Alcohol and a Carboxylle Acid. Carborundum Co., Niagara Falis, assignee of N. P. Roble, Lewiston, both

Rubber-Like Material Including 443,565. Roboce-Like Material Including the Copolymer of Butadline 1, 3 and upwards of 30% by Weight of 2,5-Dichlorostyrene. Mathieson Alkali Works, New York, assignee of J. C. Michalek, Niagara Falls, both in U.S.A

443,713. Condensation of an Alpha, Beta Unsaturated Nitrile with a Nitro-substituted Aliphatic Compound. American Cyanamid Co., New York, N. Y., assignee of J. T. Thurston, Diverside, Cong. beth in the N. S.

Riverside, Conn., both in the U.S.A.
443,730. Activating Composition for Polyvinyl Butyral Cement Including Polyvinyl Butyral in a Liquid Vehicle Including Ethanol.
Acetone, and Ethyl Ether, B. B. Chemicat
Co. of Canada, Ltd., Montreal, P. Q., assignee
of F. V. Nusent, Abington, Mass., U.S.A.
443,785. Oversen, Canadalia, Or.

of F. V. Nugent, Abington, Mass., U.S.A. 443,785. Oxygen-Containing Organic Compounds from Olefins, C. G. Bonard, London, administrator of the estate of H. Dreyfus, Jeceased, in his lifetime of London, assignee of W. H. Groombridge and R. Page, both of Spondon, both in England.

United Kingdom

89,802. Process for the Improvement of bber. Soc. Anon. Auxiliare de l'Institut Rubber, Soc. Anon. Sussembler, Soc. Anon. Sus

Materials, C. Arnold (Standard Oil Develop-

Polymerization of Olefins. C. Ardard Oil Development Co.)

Thermosetting Resins. Jicwood, 589,906. T Ltd., and R 590,000. H

Ltd., and R. L. J. Farina, 590,000. Resinous Condensation Products. Imperial Chemical Industries, Ltd., and H. S.

590,015. Unsaturated Carboxylic Acids and Esters Containing Fluorine and Polymers thereof. Imperial Chemical Industries, Ltd., 590,035. Interpolymers

590,055. Polymers and Interpolymers and Films therefrom. E. I. du Pont de Nemours

Ethyl Cellulose Molding Composi-

Polymerization of Unsaturated Organic Compounds, E. I. du Pont de Nemours & Co. Inc., and M. A. Youker.

Inc., and M. A. Youker.

Low-Temperature Polymers of Ole-Copolymers of Styrene and Acry-

lonitrile. lonitrile, Bakelite, Ltd. 590,286. Stabilized Compositions Including Chlorine-Containing Polymers, Imperial Chem-Phenolic Resin Compositions.

Vinyl Chloride. Sherwoods Paints, Interpolymers, United States Rub-

last. Polymers and Interpolymers of luoroethylene. Imperial Chemical Dichlorodifluoroethylene,

Compositions Including Polyvinyl ins. Imperial Chemical Industries. 451, **Highly Polymeric Linear Esters.** Dickson, H. P. W. Huggill, and J. C.

Alkyd Resins. Shell Development Co. 590,571. Reacting Olefins with Formalde-

hyde. E. I. du Pont C. H. Hamblet, and Styrene Fractionation, Lumn

Polymerization of Olefinic Hydro-Arnold (Standard Oil Developcarbons. Resinous Reaction Products Which from Polyhydroxy Benzenes and yde. Westinghouse Electric Inter-

Formaldehyde. national 590,654. Organo-Silicon Compounds, British

Conting Compositions.
Conting Compositions.
Iouston Co., Ltd.
Polyvinyl Chloride Compositions.
Polyvinyl Chloride, and J. J. P.
Compositions.
Thomson-Distillers (

Staudinger 590,736.

Polymerization Products of Ethylene. Polymers of Vinylidene Fluoride. E. I. du P 590,831. Plasticized Polyvinyl Compositions.

Geigy Co 590,838 Ltd., and H. Jones. Preservation of Rubber. E. I. du 590,885. Petroleum Hydrocarbon Products and Addition Agents therefor, J. C. Arnold (Standard Oil Development Co.).

Oil Development Co.).

Rubber Transformation Products.

bber Co., Ltd., F. A. Jones, and Rubber

MACHINERY

United States

2,424,558. Apparatus to Heat Seal Thermo-plastic Sheeting to Hself or to Other Mate-rials. W. R. P. Delano, New York, N. Y., assignor, by mesne assignments, to American

signor, of the control of the contro E. Rigs Akron, 6 2,424,8

Akron, O. 2,424,856. Roll-Adjusting Means for Cal-enders, Etc. C. F. Schnuck, New Haven, as-signor to Farrel-Birmingham Co., Inc., Ansignor to Farsonia, both in

both in Conn.
4,915. Vulcanizer. G. P. Bosomworth
G. Hager, assignors to Firestone Tire
ober Co., all of Akron, O.
1,917. Machine for Reclaiming Ded Machine Gun Belt Links of Resilient
ful. A. H. Brannock, assignor to FireTire & Rubber Co., both of Akron, O.
1,919. Sectional Mulds for Vilcanization 2,424,919. Sectional Molds for Vulcanizing Rubber Products. G. P. Bosomwarth

to Firestone Tire & Rubber Co., both of

Akro...
2,424,214.
Voelker, Sliverton...
Lancaster, S. C. assigno..
Co., New York, N. Y.
2,425,322. The Retreader, J. D. ...
Brooklyn, N. Y.
2,425,347. Apparatus to Test and Classify
Insulating Sheets According to Dielectric
Strength, F. R. Schmitt, New York, N. Y.
assignor, by mesne assignments, to Aerovox
New Bedford, Mass.
New Bedford, Mass.
Tester, A. L.

**Censile Tester, A. L.
**Gensile Tester, A. L.
**Ge

Corp., New Bedford, Mass.
2,423,388. Means for Making Plastic Inner
Soles. B. Oestricher, Brooklyn, N. Y.
2,425,931. Hydraulic Tensile Tester. A. L.
Golick, assignor, by mesne assignrents, to
Monsanto Chemical Co., both of Scattle, Wash,

Dominion of Canada

443,055. Apparatus for Making the Casing of a Pneumatic Tire on a Drum. Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont., assignee of K. J. Hickin and W. Holyouk, both of Birmigham, Warwick, England, 443,253. Tire Building Drum, B. F. Goodrich Co., New York, N. Y., assignee of W. B. Freeman, Cuyahoga Falls, and R. E. Lindemann, Barberton, both in O., both in the U.S.A.

United Kingdom

590.485. Vulcanizing Molds. Firestone Tire Rubber Co. 590,595. Apparatus for the Polymerization of Isoolefins. J. C. Arnold (Standard Oil De-

ppment Co.).
90,881. Apparatus to Manufacutre Cast Wingf

UNCLASSIFIED

United States

2,424,647. Anti-skid Device, O. H. Bern.

Traction-Increasing Vehicle Wheel.

2.424.64r.
Ill, Goteborg, Sweden.
2.424.799. Traction-Increasing Venu.
Colombo, Milan, Italy.
2.424.829. Cuble Clamp. A. P. Keierleber,
urora, Ill., assignor to All-Steel-Equip Co.
artion of Ill.
E. J. Sadon, Cuyahoga
E. Rubber Co.

2.424.829. Cable Clamp. A. P. Keierleber, Aurora, III., assignor to All-Steel-Equip Co., a corporation of III.
2.424.922. Brake, E. J. Sadon, Cuyahoga Falls, assignor to Firestone Tire & Rubber Co., Akron, both in O.
2.425.123. Siltting a Length of Electric Insulating Material, J. C. Quayle, Helsby, P. Jones, Kelsall, and R. Baytes, Helsby, assignes, by mesne assignments, to British Insulated Callender's Cables Ltd., London, all in England.

in England.
2.425,501. Preventing Crazing of a Flash-Heated Shape of Polystyrene. F. E. Wiley, assignor to Plax Corp., both of Hartford, Conn.

.425.644. 4. Traction Chain for Pneumatic W. Rutledge, El Paso, Tex.

Dominion of Canada

443.065. Tire Removing Tool, Firestone Tire & Rubber Co., assignee of W. H. McCollister, both of Akron, O., U.S.A. 443.187. Attaching a Fabric Handle-Forming Strap to a Sponge Rubber Wash Pad. C. E. Zimnerman, Chicago, Ill, U.S.A. 443,649. Treating Rayon Cord for Use in Belting or Pneumatic Tires. B. F. Goodrich Co., New York, N. Y., assignee of E. T. Lessig. Silver Lake, O, both in the U.S.A.

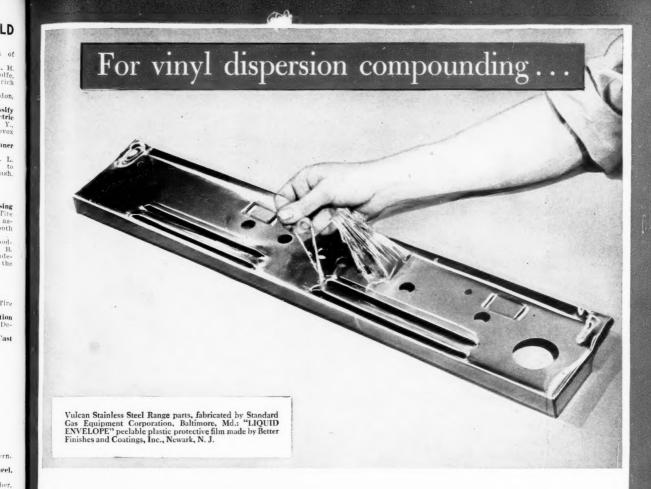
Co., New York, N. Y., assignee of E. T. Lessig, Silver Lake, O, both in the U.S.A. 443,596. **Tire Inflater and Tester.** J. For-bragd, Garden City, S. Dak., U.S.A. Decarded Alarm for Debragd, Garden City, S. Dak., U.S.A. 443,707. Pressure-Operated Alarm for De-flated Tire Indication. W. T. Sage, East Mal-

vern, Victoria, Australia, 443,746. Non-Skid Device for Wheels Having Twin Tires. Kennedy & Kempe, Ltd., Longparish, assignee of E. A. Dennison, Andover, both in Hampshire, England, 443,770. Apparatus for Dusting a Rubber Article, B. F. Sturtevant Co., Boston, assignee of C. E. Blanchard, Randolph, and A. W. Ferre, Wellesley, all in Mass, U.S.A.

United Kingdom

589,826. Means for Indicating Loss of P sure in Inner Tubes of Pneumatic Tires. T. Sage.

Cutting Thermoplastic Webs. lanese Ltd. Hose Couplings. British Tire & 599,129. Hose Couplings, British Tire & Rubber Co., Ltd. 590,307. Anti-Skid or Gripping Devices for Footwear, J. Lawn.



MONOPLEX 16 gives low volatility and low water extraction, plus low cost

Whether you are making strip coats, coated fabrics, or molded vinyl compounds, you'll want to learn more about MONOPLEX 16. For this new, high molecular weight, monomeric, nitrile-type plasticizer is especially well suited for dispersion compounding of vinyls. Just blend MONOPLEX 16 and vinyl powder, spread in paste form on fabric or in mold, and flux at normal temperatures.

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Because of its low solvency for polyvinyl chloride at room temperature, plasticizer-resin compositions can be stored without gelation at temperatures normally encountered — yet still give rapid and complete fluxing.

MONOPLEX 16 compounds (stabilized with basic lead carbonate) have excellent resistance to both heat and ultra-violet. This shows to advantage particularly in flame-proof compounds which contain tricresyl phosphate, where MONOPLEX 16 greatly improves the stability of the product.

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WASHINGTON SQUARE, PHILADELPHIA 5, PA.

TRADE MARKS

United States

431,652. Uformite. Bonding agents. Resinous Products & Chemical Co., Philadelphia.

Pa. 431,674. Okobestoprene. Electric cable tape, sheaths, and insulation. Okonite Co., Passaic,

431,674. Ukobestoprene, racette, A. J. sheaths, and insulation. Okonite Co., Passale, N. J. 431,761. Elastron. Rubber-like wristwatch straps. Industrial Synthetics Corp., Irvington. N. J. 431,777. Ruberlyke Plastic, Soling and floor covering. F. D. Mayer, doing business as Reyam Plastic Products Co., Chicago, Ill. 431,832. Tardex. Accelerators. Firestone Tire & Rubber Co., Akron, O. 431,844. Polyac, Accelerator. E. L. du Ponte & Nemours & Co., Inc., Wilmington, Del. 431,958. Tenamene, Antioxidant, Tennessee Eastman Corp., Kingsport, Tenn. 431,959. Staybelite Ester, Adhesive resin. Hercules Powder Co., Wilmington, Del. 431,951. TMP. Trimethylolpropane. Heyden Chemical Corp., New York, N. Y. 431,958. Coverine. Resins. Shoe Covers Corp., New York, N. Y. 431,993. Representation of a blue ribbon across which appears the word: "Cordovan." Tires, tubes, brake lining, etc. Okes & Co., Chicago, Ill.

across which appears the word: "Cordovan."
Tires, tubes, brake liming, etc. Okes & Co.,
Chicago, Ill.
431,999. Brewster. Tires. Vanderbilt Tire &
Rubber Corp., New York, N. Y.
432,013. WireCord. Tires and tubes. Firestone Tire & Rubber Co., Akron, O.
432,020. Plasticote. Coating compound.
Plasticote Fabrics Corp., Paterson, N. J.
432,021. Bonded Beauty. Plastic film.
Thermoplastic Fabrics Corp., New York, N. Y.
432,034. Representation of a cross-section
of a tire with the word: "Preserv-a-shape."
Retreaded or recapped tires. L. A. Stephens,
Cleveland, O.
432,064. Representation of a section of insulated wire. Wires or conductors. Acorn
Insulated Wire Co., Inc., Brooklyn, N. Y.
432,088. Okoprene. Electric cable tape,
sheaths, and insulation. Okonite Co., Passaic,
N. J.
432,102. Representation of an Indian within
an arrow-head and the word: "Mohawk."
Tires, tubes, camelback, etc. Mohawk Rubber
Co., Akron, O.
432,119. Wireflex, Wires and cables. General

an arrow-head and the Tires, tubes, camelback, etc. Mohawk Rubner Co., Akron, O. 432,119. Wireflex, Wires and cables, General Cable Corp., New York, N. Y. 432,173. James Arnold, Raincoats, A. Sagner's Son, Baltimore, Md. 432,190. Elasticool, Elastic fabric, Rayflex Pabrics, Inc., New York, N. Y. 432,203. Spliepad, Electrical splice wrapping, Underground Specialties, Inc., New York,

ner's Son, Baltimore, Md.
432,190. Elasticool. Elastic fabric. Rayflex
Fabrics, Inc. New York, N. Y.
432,203. Spliepad. Electrical splice wrapping. Underground Specialties, Inc., New York, N. Y.

Foreign Trade Opportunities

The firms and individuals listed below have recently expressed their interest in buying in the United States or in United States representations. Additional information concerning each import or export opportunity, including a World Trade Directory Report, is available to qualified United States firms and may be obtained upon inquiry from the Commercial Intelligence Unit of the United States Department of Commerce, or through its field offices, for \$1 each. Interested United States companies should correspond directly with the concerns listed concerning any projected business arrangements.

Export Opportunities

Export Opportunities

Reynaldo L. Bronnert, representing R. L. Bronnert, Rua Boa Vista 116, and Industria e Artefatos de Papeis "IAP" Ltda., 520 Alameda Cleveland, both of Sao Paulo, Brazil: machinery for the rubber industry.

A. E. Vanthaliwala, 59 Nagdevi St., Bombay 3, India: rubber heles and soles, rubber sheeting. FITAB, Fabbrica Italiana Termometri & Afimi, 77 Via S. Felice, Bologna, Italy: sanitary rubber goods.

Charles Walter McKay, representing Dunlop Rubber Australia, Ltd., 108 Flinders St., Melbourne, Victoria, Australia: raw materials used in the rubber industry.

Alexis Khoury, representing Haji Khoury & Co., P. O. Box 411, and Syrian Trading Co., P. O. Box 410, both in Damascus, Syria: tires, tubes, refrigerators.

CEAT GOMMA, 1 Corso Palemo, Turin, Italy: machinery for the production of rubber articles,

Force & Chauffage, S. A., 193 Rue de Progres.

articles,
Force & Chauffage, S. A., 193 Rue de Progres,
Frussels, Belgium: electric wire, cable and cord.
Achille Vangenhende, 48 Rue Thiefry, Brussels,
Belgium: supplies for corset and girdle making,
M. & N. Horne, Ltd., 419-27 St. Jehn St.,
London, E.C.I, England: elastic for ladies' garments.

FINANCIAL

Baldwin Rubber Co., Pontiac, Mich. Year ended June 30: net profit, \$855,968, equal to \$2.72 a share, against \$294,977, or 94¢ a share, in the preceding fiscal year.

Thiokol Corp., Trenton, N. J. First half, 1947: net profit, \$40,485, against net loss of \$12,608 in the 1946 period.

Denman Tire & Rubber Co., Warren, O. First half, 1947: net income, \$115.857, equal to 52¢ each on 197.075 common shares, against \$103.975, or 83¢ a share, in the '46 half; net sales, \$1,901.684, against \$1.072.082. the '46 hall \$1,973,989.

Faultless Rubber Co., Ashland, O. Year ended June 30, 1947: net profit, \$458,411, equal to \$3.50 a share, against \$281,999, or \$2.15 a share, in the preceding 12 months.

Dividends Declared

COMPANY	STOCK	RATE	PAVABLE	STOCK OF RECORD
American Hard Rubber Co	Pfd.	\$7.00 accum.	Nov. 1	Oct. 31
American Hard Rubber Co	7% Pfd.	1.75 g.	Sept. 30	Sept. 16
Anaconda Wire & Cable Co	Pfd.	3.00	Oct. 21	Oct. 10
Boston Woven Hose & Rubber Co	Com.	4.00 extra	Jan. 2	Nov. 14
Boston Woven Hose & Rubber Co	Com.	0.50 q.	Nov. 25	Nov. 14
Canada Wire & Cable Co., Ltd	B.,	1.00 resum.	Sept. 15	
Canada Wire & Cable Co., Ltd	"A"	2.00	Sept. 15	Aug. 30 Aug. 30
Canada Wire & Cable Co., Ltd	"A"	2.00	Dec. 15	Nov. 29
Converse Rubber Co	1st Pfd.	0.25 q.	Oct. 8	Oct. 1
Converse Rubber Co.	2nd Pfd.	0.20 q.	Oct. 8	Oct. 1
De Vilbiss Co	Com.	0.25	Oct. 20	Oct. 10
Denman Tire & Rubber Co	Com.	0.10 q.	Oct. 1	Sept. 20
Denman Tire & Rubber Co	Pfd.		Oct. 1	
Electric Storage Battery Co	Com.	0.1232 q. 0.75	Sept. 30	Sept. 20
Faultless Rubber Co.	Com.	0.25	Oct. 1	Sept. 15 Sept. 15
General Cable Corp.	Com.	0.25	Nov. 1	Oct. 1
General Tire & Rubber Co.	4 a co Pfd.	1.06 i q.	Sept. 30	
General Tire & Rubber Co	334 °c Pfd.	0.9334		Sept. 19
General Tire & Rubber Co	31, % Pfd.	0.81 1 9.	Sept. 30	Sept. 19 Sept. 19
Goodyear Tire & Rubber Co	\$5 Pfd.	1.25 q.	Sept. 30 Dec. 15	Nov. 14
Goodyear Tire & Rubber Co	Com.	1.25 q. 1.00	Dec. 15	Nov. 14 Nov. 14
Goodyear Tire & Rubber Co, of Canada, Lt l.		3.00 extra	Oct. 1	
Goodyear Tire & Rubber Co, of Canala, Ltl.	Com	1.00 g.		Sept. 10
Jenkins Bros.	Com.		Oct. 1	Sept. 10
Jenkins Bros.	Fdrs. Shrs.	0.50 q.	Sept. 25	Sept. 12
Jenkins Bros.	Pfd.	2,00 q,	Sept. 25	Sept. 12
Mansfield Tire & Rubber Co.	Com.	1.75 q.	Sept. 25	Sept. 12
Mansfield Tire & Rubber Co.	Pfd.	0.25 q.	Sept. 20	Sept. 10
Midwest Rubber Reclaiming Co.	Pfd.	0.30 q.	Oct. 1	Sept. 15
Pharis Tire & Rubber Co.	Com.	0.56 q.	Oct. 1	Sept. 15
Rome Cable Corp.	Com.	0.15	Oct. 10	Sept. 25
Rome Cable Corp.	4% Cum. Conv.	0.15	Oct. 1	Sept. 10
Rome Came Corp.	Pfd.	0.20	()	E 10
U. S. Rubber Reclaiming Co	Pfd.	0.30 q.	Oct. 1	Sept. 10
	Com,	0.35 g.	Oct. 1	Sept. 26
China Mandella W Mandell Co	Com.	0.1752 q.	Jan. 2	Dec. 10

Estimated Automotive Pneumatic Casings and Tube Shipments, Production, and Inventory—July and June, 1947—First Seven Months, 1947, 1946

PASSENGER CASINGS	July	% of Change from Preceding Month	June	First Seven Months	1946, First Seven Months
Shipments Original equipment Replacement Export Total Production Inventory end of month	1,507,442 4,481,085 123,037 6,111,564 5,474,573 4,283,995	- 1.53 10.29 14.40	1,715,660 4,344,848 145,800 6,206,308 6,102,243 5,004,653*	11,192,484 30,294,592 966,871 42,453,947 45,104,686 4,283,995	4,649,645 30,721,008 318,067 35,688,720 35,866,528 2,009,927
TRUCK AND BUS CASINGS					
Shipments Original equipment Replacement Export Total Production Inventory end of month	466,673 749,845 112,559 1,329,077 1,315,208 1,554,193	+ .74 -11.17 - 0.65	414,427 748,838 156,024 1,319,289 1,480,506 1,664,861*	3,328,762 5,550,065 959,106 9,837,933 10,705,682 1,554,193	1,965,858 6,392,922 452,624 8,811,404 8,841,196 808,591
TOTAL AUTOMOTIVE CASINGS					
Shipments Original equipment Replacement Export Total Production Inventory end of month	1.974,115 5,230,930 235,596 7,440,641 6,789,781 5,838,188	- 1.13 - 10.46 - 12.47	2,130,087 5,093,686 301,824 7,525,597 7,582,749 6,669,514*	14,521,246 35,844,657 1,925,977 52,291,880 55,810,368 5,838,188	6,615,503 37,113,930 770,691 44,500,124 44,707,724 2,818,518
PASSENGER AND TRUCK AND BUS	TUBES				
Shipments Original equipment Replacement Export Total Production Inventory end of month	1,969,501 4,050,719 196,028 6,216,248 4,542,333 7,909,415	+7.56 -16.50 -15.97	2,154,738 3,364,183 260,400 5,779,321 5,440,047 9,412,920*	14,512,982 27,007,544 1,721,185 43,241,711 47,309,188 7,909,415	6,606,25 3 31,563,86 3 727,52 2 38,897,63 8 39,799,086 3,906,610

Note: Cumulative data on this report includes adjustments made in prior months. Source: The Rubber Manufacturers Association, Inc. Revised

rren, 5,857, nmon ainst

RLD

Year 8,411, 1,999,

luc-946 6, st en ths

724 518

October, 1947

Calco's Rubber Chemicals go

THROUGH THE MILL"



Milling and vulcanizing of rubber on a small scale is carried on in Calco's Research Laboratories—to test the performance of Calco chemicals in rubber manufacturing processes and their effect on the finished product.

The chemicals literally and figuratively go "through the mill," and the finished rubber is rigorously tested to determine its flexibility, tensile strength, tearing and abrasion resistance, low temperature performance, heat build-up, and performance after accelerated aging.

Such painstaking analysis and research are the rubber manufacturer's assurance that Calco chemicals meet the specifications required for manufacturing economy and quality of finished product.

entatives and Warehouse Stocks: Akron Chemical Company, Akron, Ohio Ernest Jacoby & Company, Boston, Mass. • Herron & Meyer of Chicago, Chicago, Ill.
H. M. Royal, Inc., Los Angeles, Calif. • H. M. Royal, Inc., Trenton, N. J. • In Canadas
St. Lawrence Chemical Company, Ltd., Montreal and Toronto.



RUBBER CHEMICALS DEPARTMENT CALCO CHEMICAL DIVISION AMERICAN CYANAMID COMPANY BOUND BROOK . NEW JERSEY

OTS Bibliography Reports on Rubber Products — IX

THE abstracts printed below are taken from the Department of Commerce's weekly publication." Bibliography of Scientific and Industrial Reports'. Copies of the complete reports, either on microfilm or as photostats as indicated, may be obtained from the Office of the Publication Board, Department of Commerce, Washington 25, D. C.

Process for the Production of Plastic, Easily Workable Synthetic Rubber, I. G. Farbenindustrie, PN-16347, May, 1942, 14 pages, Photostat \$1; microfilm 50c. This covers an intended patent application for a process for production of butatione hydrocarbons or of their mixtures with other polymerizable materials. The polymer dispersions are coagulated by nitrons acid, by addition of other precipitating agents, or by increased temperatures. Accompanying are previous and subsequent correspondence on the subject. (In German.)

Summary Report, German Synthetic Insula-tion for Wire and Cable. Rubber Bureau, WPB. PB-16-391, 1945–28 pages. Photo-stal \$2; microfilm 56e. Extensive technical data were obtained on compounding, construc-tion, and processing of rubber insulated cables. Buna 8 and polyvinyl chloride plastics were most commonly used for low-voltage flexible cables. For voltages above 3000, oil-impreg-nated cable was the principal insulation. Poly-strene was favored for high-frequency appli-cations. There is a discussion of the types of Buna and other materials used, and of Ger-nan wire and cable practices. Typical com-pound formulations for several classes of in-sulations are given.

Procedure for Production of Polymerization Frocedure for Production of Polymerization Products 1. G. Farbenindustrie, PB-16379, November, 1936, to February, 1946, 29 pages, Photostat \$2; microfilm 50e, This series of papers contains correspondence and related material on the production of rubber-like polymerization products characterized by the polymerization of butaflene or its substituted products in the presence of isobutyl polymers. Four examples are given. These documents are intended for patent applications in Germany and other countries,

Method for Improving the Chemical Resistance of Elastic Molded Parts of Natural or Synthetic Rubber, I. G. Farbenindustric, PB-16350, January, 1939, 3 pages, Photostat \$1; microfilm 50c, The novelty of this intended patent application lies in the coating of these molded rubber parts with polyisobutylene. (In German).

Laboratory Procedures for Distinguishing between Natural and Synthetic Rubber Products, P. Kluckow. PB-17613. 8 pages, Photostat \$1; microfilm 50c. This is a compilation of procedures for distinguishing between different rubbers, The characteristic odor of natural rubber, when burning, is indicated as being the simplest method. Vulcanized synthetic rubbers also have a typical odor either cold or when burning. The identification of the thermoplastics is described by their physical properties and general appearance. (In German.)

High-Grade Vulcanizable Rubber Substitute, G. Farbenindustrie, PB-16372, May, 1931, February, 1936, 20 pages, Photostat \$2; icrofilm 50¢. The products obtained in I. G. Farbenindustrie, PB-16372. May, 1931, to February, 1936, 20 pages, Photostat \$2; microfilm 50c. The products obtained in emulsion polymerization of butadiene are purified by extraction or reprecipitation and then blended with non-volatile organic compounds or their mixtures, Such compounds are mineral, vegetable, or animal oils, fats, and waxes, as well as residues, resins, acids, and bitumens. Proper choice of the ratio of polymeric hydrocarbon to this latter compound may lead to durable substitutes of rubber for tires, belling, and other mechanical goods. The documents are correspondence relating to a patent application, (In German.)

Method of Concentration. I. G. Farben-industrie. (German patent application 157318 IVc/39b(4/01). PB-16355. May, 1942. 2 pages. Photostat \$1: microfilm 50c. This method is intended for concentration of emulsions of butadiene polymers which contain alkyl naphthalene sulfonic acids and cannot readily be concentrated by mechanical means. After the emulsions are cooled at temperatures between 0 and 15° C., separation can be done by centrifuging, filtering, or pressing (In German.)

Continental Gummiwerke, Hanover, W. 1 D. A. Schatzel. PB-104 Confinental Gummiwerke, Hanover. W. L. White and R. A. Schatzel. PR-1045. 1945. 15 pages. Photostat \$1: microfilm 50c. This company was the largest manufacturer of rubber goods in Germany. The plant produced mechanical rubber goods, belting, hose, hydraulic brake cups, oil seals, mill and printing rolls, tank linkings, and Navy sheet and strip. Specifications for each product are given and also, where known, the method of construction or processing.

Japanese Heavy Rubber Protective Impermeable Suit and Mittens. Leslie L. Larsen. (CWS Capture Matteriel Memo Report 7). PB-20653. October, 1943. 6 pages. Photostat \$1; microfilm 50c. The one-piece suit described in this report is made of a heavy red-brown rubberlzed fabric weighing approximately seven ounces per square yard, it consists of two piles of laminated cloth coated with about eight ounces of rubber on the outside, and about 24 ounces of rubber on the inside layers. Resistance of the suit to mustard gas was of the suit to mustard gas determined.

Effects of Oils on Volume Change of Synthetic Rubbers, P. J. Mahoney. (AAF ATSC Memo Report EXP-M56-4172, Add. I.) PB-16288. September, 1942. 5 pages. Photostat \$1; microfilm 50c. The volume swell of compounds of neoprene, Perbunan, Hycar, and Chemigum was determined upon immersion in ASTM test oil and in aircraft engine lubricating oil. Tables and graphs appear, but no direct relation was noted. lation was noted.

Properties of the Synthetic Rubbers, P. J. Mahoney and others, (AAF ATSC Tech. Report 4850), PB-16847. November, 1942. 24 pages. Photostal \$2; microflim 50c. This report presents the properties of the synthetic rubbers, classified according to their chemical types. A discussion is presented of each classification and its comparision with other types, Aircraft applications and possible future uses are described.

Production of Acrylonitrile at Leverkusen Plant of I. G. Farbenindustrie. A. Cambron. (BIOS Final Report 92, Item 22). PB-19678. January, 1946. 10 pages. Photostat \$1; microfilm 50c. This is supplemental report on the production of acrylonitrile from acetylene and hydrocyanic acid. Photographs and explanations are given on the hydrocyanic acid generator and the upper part of the reactor, A flow sheet of the reaction system appears, and a diagram of acrylonitrile recovery processes is included. The composition of the cuprous chloride catalyst is noted.

Gummiwaren Fabrik Phoenix, Harburg/ Hamburg. Glen Gay, (BIOS Final Report 173, Item 22). PB-20088. February, 1946. 6 pages. Photostat \$1; microfilm 59c. This report de-scribes the manufacture of rubber footwear at this plant. Buna S, SS, and S-3 have been used. Typical formulations are included.

Method for the Manufacture of Mixtures Consisting of Vulcanizable Artificial Materials. I. G. Farbenindustrie, PB-16318, April, 1937. 5 pages. Photostat \$1; microfilm 50¢. So-called butadiene resins manufactured according to German patents \$53,589 and \$40,998 can be used advantageously as additions to mixtures of synthetic rubber. They facilitate treatment of the mixtures on rolls and kneadiers, favor the dispersion of carbon black, and improve the physical properties of the vulcanizates. In general, 4-15 parts of material are added to 100 parts of polymer. This was an intended patent application. an intended patent application.

Plasticizer or Filler for Rubber or Artificial Plasticizer or Filler for Rubber or Artificial Material I. G. Farbenindustrie, Pls-16349, November, 1938, 11 pages, Photostat \$1. microfilm 50c. This covers patent for the application of high molecular weight, undecomposed, distillable fractions of hydrogenation products, or of their residues, as fillers or plasticizers for natural and synthetic rubbers. Correspondence prior and subsequent to patent issuance is attached. (In German.) d synthetic and subse-

Laboratory Procedure for the Distinction of Natural Rubber and Its Substitutes, P. Kluc-kow, PB-16333, 7 pages, Photostat \$1; micro-film 50e. The detailed description of char-acteristics and tests is divided according to the various types of rubber and artificial rubber. (In German.)

Process for Manufacture of Mixed Polymers, 1. G. Farbenindustrie. PB-16580. November, 1936 to May, 1942. 25 pages. Photostat \$2; microfilm 50c, The manufacture of rubber-like polymerization products polymerized of mixtures of vinylethynyl carbinols and but-adiene hydrocarbons or substituted products of the latter is described, together with results of tests made on various mixtures.

Method for Production of Rubber-Like Com-Method for Production of Rubber-Like Compositions. I. G. Farbenindustrie. PB-16386, November, 1932. 3 pages, Photostat \$1; microsilm 50c. After converting methane successively into acetylene, acetaldehyde, butylene glycol, and buradlene, dichlorobutylene is then produced by chlorination, one mol of hydrochloric acid is separated, and the resulting product polymerized in the usual manner. This is a rough draft of a patent application, (in German.)

Method for Production of Artificial Rubber, I. G. Farbenindustrie, PB-16341, March, 1942, 4 pages, Photostatic \$1; microfilm 50c, Polymerization of mixtures of isoprene with a vinylethynyl alkyl carbinol and accylonitrile or methacrylonitrile in aqueous emulsion leads o artificial rubber, This was intended as the basis for a patent application. (In German.)

to artificial rubber. This was intended as the basis for a patent application. (In German.)

German Neoprene, M. A. Youker and N. A. Copeland. (F1AT Final Report 719). PB-19857. January, 1946. 39 pages. Photostat \$2: microfilm 50c. This report mainly describes production at Hoechat of monovinyl-acception of the production at Hoechat of monovinyl-acception (MVA), its chlorination to form 2-chloro-1.3-butadiene (chloroprene or CD), and the polymerization of CD to form neoprene. Although chloroprene and neoprene were considered by some German investigators to be superior to Buna in some respects, plant rivaries and Buna commitments limited neoprene production to pilot-plant size and development. Flow sheets show the various steps in the production of MVA from acceptene, and the chlorination of MVA to form CD. In the chlorination for MVA to form CD. In the chlorination process, only about 20% MVA used was chlorinated in one pass to limit the formation of by-products. A high-hooling oil was removed as soon as it formed since it helped convert CD to dichlorobutylene. The gases were also treated to obtain additional CD. A formula for the polymerization is given, and the processe described. The processes in use at two plants in Zlin. Moravia, are also described. Not much work was done in Germany on stabilizers for neoprene, and experiments to produce good copolymers were not successful. Neoprene was found to weld very well and was recommended for tire carcasses. Neoprene-impregnated paper was used as a leather substitute. Curing bass for tires lasted twice as long when made of neoprene than when made of natural rubber. Neoprene was also used for gaskets, packing, cementing, coating, and impregnation of fibers.

Oppanol (Polyisobutylene) Manufacture at the Oppan Farben Works. J. W. Livingston. (FIAT Final Report 606). PB-17564. December, 1945. 8 pages. Photostat \$1; microfilm 50¢. This covers an investigation of the production and control of Oppanol B, used by the Germans as a substitute for natural rubber in manufacturing cable, impregnating fabrics, for adhesives, and for waterproofing.

Italian Protective Rubber Gloves. Leslie L. Italian Protective Rubber Gloves. Leslie L. Larson and P. W. Sanders. (CWS Captured Materiel Tech. Report 43). PB-4556 December, 1943. 6 pages. Photostat \$1; microfilm 50¢. The report describes two types of latex dipped rubber gloves having a high resistance to liquid mustard gas. The physical and service properties indicate the gloves to be comparable to United States equipment. A chart showing physical properties of Italian gloves and comparable U. S. gloves completes the report.

Process for Manufacture of Molded Bodies.
1. G. Farbenindustrie. PB-16345. December, 1942. to February, 1944. 6 pages. Photostat \$11. microfilm 50c, Brittle to powdery emulsion polymers of butadiene hydrocarbons are finely ground and, with addition of fillers, vulcanized under pressure in closed molds or upon rolls without previous plasticizing. This is an intended patent application later withdrawn. In German.)

Development of Army-Type Dust Respirator. Richard B. Knight. (CWS Tech. Div. Memo Report 319). PB-22281. Sept., 1941, 28 pages. Photostat \$2; microfilm 50e. Procedures and findings of tests to develop a satisfactory dust respirator are described. Tests resulting in acceptance of the model E1R4 respirator are discussed. (Continued on page 138)

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The requirement was an inexpensive GR-S red compound stock with a Shore A hardness of 90. The use of Barrett Cumar* resin, EX grade, to solve this problem is shown in the following recipe and test data:

RECIPE		WEIGHT BASIS
GR-S		. 100.00
Cumar* Resin, EX Grade		
Clay		
Red Oxide		
Zinc Oxide		. 5.00
Sunproof		. 1.00
Sulfur		
Mercaptobenzothiazole		. 2.50
DPG		. 1.25
Total		
Compounded Mooney Viscosity at 100° C (1.9 Inch Rotor)	• • • • • • • • • • •	. 77
Specific Gravity		. 1.58
RHC, % by Wt		
RHC, % by Vol		
Cost per Pound		
Cure at 316° F (70 Lb.)—10 Minutes		
Tension Data:	Unaged	Aged 24 Hrs. @ 100° C
Stress—P.S.I. at 300%	750	
Tensile—P.S.I.	850	900
Elongation—%	500	230
Hardness—Shore A	90	96
Tear Resistance (Angle Die)		.720 cc. Loss/H.P. Hour

THE USE OF CUMAR* RESINS with high loadings of clay or other types of non-black fillers provides compounds which are characterized by exceptionally good extruding and molding properties. The high hardness, low cost compound shown above illustrates only one of the many ways in which these resins can be used to great advantage. Your inquiries on the use of Cumar* resins and other Barrett Rubber Compounding Materials are invited.



THE BARRETT DIVISION

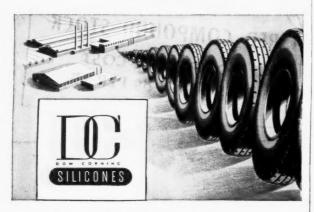
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

In Canada: The Barrett Company, Ltd., 5551 St. Hubert Street, Montreal, Que.

Even tough unloaders come out easily

Mold Release Emulsion No. 35

The Dow Corning Silicone Release Agent



Many of the major rubber companies are changing to DC Mold Release Emulsion No. 35.

★ It's Semi-inorganic and Therefore Heat Stable

Silicones, which have the same type of inorganic framework found in glass, do not decompose to form carbon deposits. They withstand temperatures of 500° F. for a long time. Hundreds of hours at vulcanizing temperatures will not break them down.

★ It Keeps Clean Molds Clean

DC Mold Release Emulsion No. 35 forms a silicone film which keeps synthetic rubber or dirt accidentally introduced into the mold from sticking to mold surfaces.

★ It Improves Surface Quality and Reduces Scrap

Clean molds and easy release make sharp clean moldings. Only a very thin silicone film is necessary. Therefore non-knits and fold-overs are practically eliminated.

★ It's Easy to Apply

Concentrations ranging from 50 to 150 parts of water to 1 part of the Emulsion are applied by spraying with conventional equipment. Even inexperienced workers get good results because the amount to be applied is not critical.

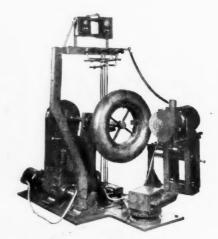
For further information request leaflet U-62 from

DOW CORNING CORPORATION, MIDLAND, MICHIGAN

Chicago: 228 N. La Salle Street • Cleveland: Terminal Tower
Los Angeles: 634 S. Spring Street • New York: Empire State Building
Canada: Fibergles Canada, Ltd., Toronto • England: Albright & Wilson, Ltd., London



New Machines and Appliances



Akron Standard Airbag Buffer

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Salts

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Airbag Buffing Machine

A NEW airbag buffing machine that will handle any bag from 14 to 24 inches inside diameter and from 4.40 to 14.00 inches in cross-section, has been announced by The Akron Standard Mold Co., Akron 5, O. With one operator using two of these machines, it is possible to buff bags at the following speeds: sizes 4.40-21 to 6.00-16, 18 per hour; sizes 6.00-16 to 7.50-20, 16 per hour; sizes 8.25-20 to 9.00-20, nine per hour; and sizes 10.00-20 and up six per hour.

sizes 10.00-20 and up, six per hour.

Time studies have shown that one operator can operate more than two of these buffing machines, but the company's standard recommendation is one operator for two machines. While one machine is buffing one side of a bag, the operator turns the other bag on the second machine. The efficiency in operation obtained by the use of two machines is derived from the fact that each machine will buff only one side of a bag without turning. A standard emery wheel, 10 by two by 13% inches in size, is used which can be obtained from various suppliers.

Die Cutting Press

THE new Hobbs "Tri-Power" die cutting press, announced by Hobbs Mfg. Co., 26 Salisbury St., Worcester, Mass., has already undergone many successful tests under actual working conditions in a wide variety of industries. Tremendous power and rigidity are incorporated into the press by virtue of its unusual construction, it is claimed. Power is transmitted to the head from a two-h.p. motor via a 24-inch, 470-pound flywheel revolving at about 600 r.p.m., helical cut gear, a main crankshaft of high carbon steel, and two steel connecting rods to the 1,000-pound head.

The upper end of each connecting rod is locked to the upper cross-shaft which carries the head, and the bottom end is fitted with a large diameter roller bearing. There can be no wearing of bushings, stretching of rods, or loosening of connections. The press is equipped with sealed prepacked roller and ball bearings positively lubricated by means of alemite fittings. The press head cannot give or twist under normal conditions. Head bearings are 13 inches long and four inches wide, and each end of the head has four bearings, or a total of 416 square inches of hearing space. For additional strength a cast-iron cap locks the head in

The press is readily adaptable to a wide variety of uses by virtue of a clutch and brake which allow several different types of operation, from jogging to continuous run or single stroke. The front of the press has a roller cradle mounted on needle bearings to eliminate the manual work of pushing in and pulling out work being done. All controls are within easy reach of

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ull-1 0 in a series of Armour reference aids for the chemical processing industries

a helpful guide to.

"THE SELECTION AND **USE OF FATTY ACIDS"**

Each individual fatty acid has certain definite properties - properties which differ from those of any other fatty acid. Mixtures of two or more of these pure acids likewise have distinctive characteristics which make some of them suitable, some unsuitable for any one specific use.

This helpful booklet outlines the major fields of usage for fatty acids and their derivatives, explaining for each the properties needed, functions performed, and types of acids commonly used. Applications discussed include:

Protective coatings; water-soluble soaps; metallic soaps; lubricants; rubber; textiles; cosmetics and toiletries; edible products; waxes and polishes; metal working; leather; chemicals; putties, caulking compounds, cement and adhesives; insecticides, fungicides and disinfectants; synthetic detergents; paper; synthetic resins.

If you have not already selected Armour's Neo-Fats for your own use, it will pay you to investigate their many advantages for your products and processes. The fractionally-distilled Neo-Fat fatty acids and their derivatives -the amines, amides, nitriles and quaternary ammonium salts-are available in quantity for prompt delivery.

Our Technical Department will be glad to recommend the specific Neo-Fat or derivative best suited to your needs.



Mail this coupon today!

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Armour Chemical Division, Armour and Company 1355 West 31st Street, Chicago 9, Illinois

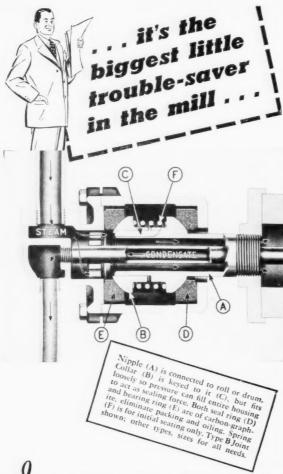
Please send me, without charge, the booklet "The Selection and Use of Fatty Acids.'

Title Firm Name

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1355 W. 31st Street . Chicago 9, Illinois



n terms of physical size alone, the Johnson Joint could hardly be called big machinery. But in its ability to save time and trouble, and promote plant efficiency, its stature approaches anything the industry has ever seen.

The Johnson Joint was designed to go after the old stuffing box and steam fit troubles in a business-like way, and it literally knocks the stuffing out of them. There's no packing of any kind. There's no oiling required, ever. There's no adjusting - the higher the pressure, the tighter the seal. There's little to fear from misalignment - with provision for both lateral and angular movement built right in. Note besides how neatly it provides for more efficient syphon drainage, through the same head that admits the steam.

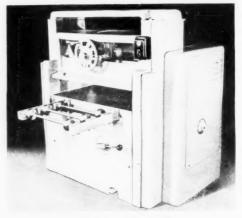
In dollars and cents, what does all this add up to? Well ... enough at least to pay the cost of switching over to Johnson Joints in just a short while. Enough certainly to make the Johnson Joint too big to overlook.

THE JOHNSON CORPORATION

869 WOOD STREET, THREE RIVERS, MICHIGAN



Write for literature and the name of your nearby Johnson representative.



Hobbs "Tri-Power" Cutting Press

the operator. The entire mechanism is completely enclosed, compact, neat in appearance, and completely safe. The press is available in two sizes: 24 by 38 inches, and 24 by 44 inches.



Dial Gages



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Ames Pocket Thickness Measure No. 25

(Left)

Ames Dial Comparator No. 2

WO micrometer dial gages for accurate and speedy measurement of rubber thickness and size are being made by the ment of rubber thickness and size are being made by the B. C. Ames Co., 59 Ames St., Waltham 54, Mass. The Ames dial comparator No. 2 is small, standing 53%-inches high exclusive of weights, weighs only 234 pounds, and is very stable. Contact diameters and spindle dead weights in accordance with A.S.T.M. and other specifications are available. The comparator can also be furnished without spindle dead weights. The two-inch diameter table is turned to raise or lower the work and bring the pointer to zero. A knurled screw at the side locks the table in the desired position. The lever at the left of the indicator is pressed down to lift the indicator spindle, while releasing the lever permits the spindle to return quickly to the measuring position. Indicators available for use with the comparator are graduated in thousandths, half-thousandths, or ten-thousandths of an inch, with metric divisions also available. Short, medium,

and long-range types can be had in each classification.

The Ames pocket thickness measure No. 25 is a precision dia gage weighing only three ounces and having an 15%-inch dial diameter and ½-inch case thickness. Drawing back of the index finger on the knurled wheel at the top causes an extremely sensitive mechanism to respond instantly to raise the upper anvil, permitting insertion of the sheet or object to be measured. Release of the knurled wheel by the finger allows the upper anvil to close with automatic uniform contact pressure over the entire range of the gage: 0.000- to 0.3125-inch. The dial reads in thousandths of an inch, with fractions read by interpolation (Continued on page 12?)

New Goods and Specialties

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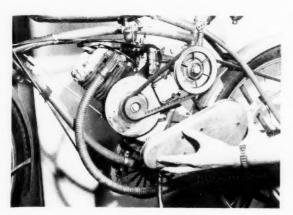
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Whizzer Unit for Converting Bicycles to Motorbikes Uses New Goodyear "Compass-V-Steel" Belts

Converts Bicycles to Motorbikes

RDINARY bicycles can now be converted into speedy gasoline-driven motorbikes within a few hours as a result of a new principle in V-belt construction. The belt utilizes endless steel cables for carcass reinforcement, a new development by Goodyear Tire & Rubber Co., Akron, O. Each cable comprises 21 tightly woven strands of high-tensile steel wire.

Already in use as original equipment, the new "Compass-V-tell' letter are reported by the compass-V-tell' letter are reported by the compass-V-tell' letter.

Already in use as original equipment, the new "Compass-V-Stel" belts are now being supplied to the Whizzer Motor Co. as auxiliary power equipment for bicycles. The steel-cable belt for a bicycle unit transmits power from the motor to a jack-shaft. A second belt connects the jack-shaft with a sheave attached to the rear wheel. The belt is designed to provide maximum strength and still be elastic enough to absorb the engine pulsations without vibration.

Flexible Neoprene Polishing Wheel

A NEW addition to its line of polishing and finishing wheels has been announced by Manhattan Rubber Division, Raybestos-Manhattan, Inc. The new wheel is the most flexible of the company's soft neoprene bonded polishing wheels. The ex-



STAMFORD "FACTICE" VULCANIZED OIL

(Reg. U. S. Pat. Off.)



Our products are engineered to fill every need in natural and synthetic rubber compounding wherever the use of vulcanized oil is indicated.

We point with pride not only to a complete line of solid Brown, White, "Neophax" and "Amberex" grades, but also to our aqueous dispersions and hydrocarbon solutions of "Factice" for use in their appropriate compounds.

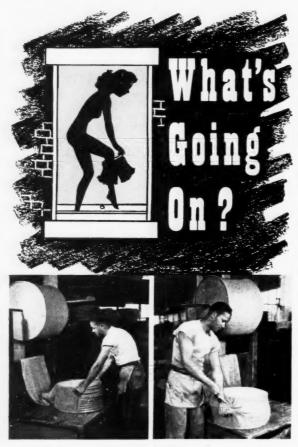
Continuing research and development in our laboratory and rigid production control has made us the leader in this field.

The services of our laboratory are at your disposal in solving your compounding problems.

THE STAMFORD RUBBER SUPPLY COMPANY

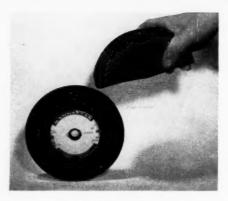
Stamford, Conn.

Oldest and Largest Manufacturers of "Factice" Brand Vulcanized Oil Since 1900



JEFCO JUTE TUBING'S GOING ON! This new kind of seamless, continuous, tubular baling cloth is going on packages of all sizes and shapes... and it's saving up to 80 per cent in baling time in shipping rooms all over the country! It's different because it s-t-r-e-t-c-h-e-s... providing smooth, close-fitting coverage for a wide variety of sizes and shapes. And it cuts labor costs substantially because it's so easy to use.





Showing Flexibility of New Manhattan Polishing Wheel

treme flexibility and cushioning action of the wheel are due to the bonding of a specially modified neoprene compound impregnated with abrasive grains.

Manufactured under patented processes, the wheel can be varied over a wide range of densities, depending on its ultimate application. To obtain a wheel giving superior finishes, a combination of porosity and a soft bond is required, and the nature of this soft bond necessitates that the speed of the wheel be limited to 3,000 st.p.m. The new wheel has already found application in the finishing of stainless steel, glass, and non-ferrous and precious metals. It is supplied in the finer abrasive grains, or with pumice, rottenstone, or other mild abrasives, and is said to be very effective in blocks and rubbing pads as well as in wheel form.



Protective Suit

THE Ipco one-piece neoprene suit, designed for protection against splashes and sprays of heavy acids, caustics, and oils in inspecting and repairing acid equipment, pipe lines, cleaning tanks and vats, and in general emergencies, has been placed on the market by Industrial Products Co. The suit is made of double coated neoprene material fully vulcanized at all seams. It has a corduroy tipped stand-up collar and a full-length heavy-duty zipper which allows ease in donning or removing the suit. The zipper fully closes the opening and, in addition, is protected by an over-lapping fly front which securely fastens down with snap buttons. Sleeves are fitted with gum neoprene cuffs on the inside which fit close to the wrist. Extra reinforcement is provided on the bottom inside of the trouser legs to give additional wear and acid re-sistance. The suit is made in three sizes: small (36-38), medium (40-42), and large (44-46).

Dial Gages

(Continued from page 120)

Each complete revolution of the pointer is 0.1 inch and is shown by a groove in the spindle as it moves up through the case. Decimal equivalents of fractions are stamped into the back of the case. The thickness measure is sturdily constructed to be capable of giving a lifetime of trouble-free service. The ½-inch diameter anvils with their low contact pressure permit the use of the gage for measuring soft as well as hard rubbers and also many of the various combinations of rubber with cloth and metals.

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Controls off on Reclaimed and Scrap Rubber

The Control of Rubber (No. 23) Order, 1944, which fixed aximum prices for rubber waste and scrap and for reclaimed rubber and also prohibited the production of reclaimed rubber except under license, has been superseded by a new order (No. 28), 1947, issued by the Board of Trade and effective from July 22, which releases these rubbers from official control. The removal of this control is the natural corollary to the restoration of a free market in natural subber which took place last Lanuary. of a free market in natural rubber which took place last January. and it is expected that the prices of scrap and reclaimed rubber

will now realine themselves to current prices of natural rubber. Scrap rubber and reclaimed will still be subject to export control, but for the present export licenses will probably be freely granted except in the case of a few of the higher qualities of scrap rubber still in short supply in the United Kingdom.

Colonial Development Corp. Planned

It was recently announced in the House of Commons that the government proposes to establish a Colonial Development Corp. with total borrowing powers of £100,000,000, since the Colonial Development and Welfare Act, which provides money for improvement of social and other services and has been and still is very useful, is not far-reaching enough.

The new corporation would operate on commercial principles; The new corporation would operate on commercial principles; it would supplement, but not supplant private enterprise, establishing or assisting any enterprise in the colonies designed to increase their general productive capacity. It is proposed to give the corporation power to conduct enterprises itself, to set up subsidiary organizations to run individual projects, or to give assistance to existing enterprises. Its operations, however, would require the preliminary consent of the Secretary of State and of the Colonial Government concerned so as to insure that any proposed enterprises were conducted in the way best suited to pro-mote the welfare of the colonial peoples.

Company News

Kautex, Ltd., has been formed with a capital of £100,000 to manufacture and deal in cork and cork substitutes; plastics, rubbers, bonding and molding materials, pneumatic and other tires.

Rubber Improvement, Ltd., rubber reclaimer and rubber and plastic compounder, will increase its capital from £250,000 to £350,000 by the creation of 50,000 additional preference shares

of £1 each and 200,000 ordinary shares of 5s. each. The company is to be converted to a public company.

Anglo-Johore Rubber Plantations, Ltd., has been formed with a capital of £125,000 in 2,500,000 shares of 1s. each to acquire the undertaking and all or any part of the assets and liabilities of Anglo-Johore Estates Ltd. (incorporated April 15, 1937) and to acquire estates in the Malayan Union, The Colony of Singapore, Java, British possessions in the East, Netherlands India and elsewhere.

Wallington, Weston & Co., Ltd., Frome, Somerset, recently held a dual celebration to commemorate its fiftieth anniversary and at the same time the opening of new works, rebuilt from

and at the same time the opening of new works, rebuilt from old mills, at Vallis Rd. The company produces plastic materials under the trade name of "Fromoplas" and "Fromoshell," as well as a variety of sponge rubber articles including bath mats, table mats, bath sponges, balls, etc. Among its specialties is the Sorbo ball, invented by G. W. Leeson, a director of the firm.

Recently released figures show the effects of the coal crisis in February on the output of rubber goods, as indicated by the consumption of natural and synthetic rubber. In January, 1947, consumption, covering a five-week period, came to 14,828 tons; the coal crisis caused a drop in February (for a four-week period) to 5,882 tons; but by March (a four-week period again), consumption rose to 11,084 tons, and to 13,720 tons in April (again a five-week period). Consumption of rubber for tires and tubes of all kinds and repair materials was 8,855 tons in January; 3,159 tons in February, and 8,089 tons in April. January; 3,159 tons in February, and 8,089 tons in April.

A new company to manufacture chemicals from petroleum in

CATALYSTS FOR LOW PRESSURE LAMINATES AND CAST RESINS

4 UBS PEROXIDES specifically created for polymerizing and curing of polyester type resins.

1-HYDROXYCYCLOHEXYL HYDROPEROXIDE-1

Thermal Decomposition: 71°C

Soluble in organic solvents. Insoluble in water.

Form: White crystalline solid.

I.C.C. Classification: Oxidizing material.

60% TERTIARY BUTYL HYDROPEROXIDE

Thermal Decomposition: 89°C

Soluble in short chain aliphatics and aromatics.

Form: Water white liquid.

I.C.C. Classification: Inflammable liquid.

T-BUTYL PERBENZOATE

Thermal Decomposition: 116°C

Soluble in organic solvents. Insoluble in water.

Form: Straw colored liquid.

I.C.C. Classification: Inflammable liquid.

DI-TERTIARY BUTYL DIPERPHTHALATE

Thermal Decomposition: 108°C

Soluble in organic solvents. Insoluble in water.

Form: White crystalline solid.

I.C.C. Classification: Oxidizing Material.

Write for further information and Technical Data Sheets containing complete properties.



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the United Kingdom is to be formed jointly by the Distillers Co. and the Anglo-Iranian Oil Co. It is expected to increase supplies of industrial alcohols, as well as basic materials for the plastics industry. The Distillers Co. has considerable interests in the plastics industry through its subsidiary, British Resin Products. The Anglo-Iranian company operates two refineries in the United Kingdom, one at Llandury, in Wales, and the other at Grangemouth in Scotland. The new enterprise will require a capital of about £5,000,000, which will be held equally by the two concerns involved. Where the factory is to be located has not yet been revealed.

FRANCE

Resistance of Natural Rubber in Solvents

In a consideration of the problem of improving the resistance of natural rubber to solvents Le Bras and Compagnon point to the considerable progress already made in this direction as an indication that the expectation that natural rubber may yet compete with the synthetic product in this respect can no longer be considered Utopian. The investigators describe a number of processes patented in the last decade and select as the most promising the method involving partial hydrochlorination of rubber, because of the outstanding properties of the resultant vulcanizates. Another promising method involves the action on rubber of unsaturated compounds like acyrlic nitrile, because of the simplicity of the technique and the notable characteristics it yields.

Role of Latex in Rubber-Bearing Plants

The oft-considered question of the role of latex in rubber-bearing plants, with special reference to *Hewea*, is the subject of a study by M. Ferrand, director of the Research Center of the L. R. H. O., which he offered in a course given at the Institut Français du Caoutchouc in Ma.ch. 1946, and which appears in condensed form in print.²

M. Ferrand shows that with regard to Herea, kok-sughyz, and Chondrilla, at least, the rubber is formed locally, in latex vessels which function as organs of secretion; further that the claboration of latex is influenced by factors which also influence assimilation, that is to say, light, temperature, and humidity. On the basis of his observations he concludes that latex vessels play a very active part in the life of lactiferous plants which are provided with them, participating in the metabolism of such plants by the alimentary substances which they claborate and store momentarily. Besides containing alimentary substances, the latex system helps maintain a proper aqueous equilibrium in the living tissues. At the same time the latex vessels also retain waste products which are eliminated by the aging of the tissues. In short, M. Ferrand believes that the latex system is to be regarded as a great regulator of the general nutrition of the plant.

Rubber Industry Notes

In a recent issue of *l'.Agronomic Tropicale*, monthly organ of the Ministry for Colonies, attention is called in two studies to the special qualities and possible uses of Ramie fiber. It is pointed out that its toughness and resistance to atmospheric influences, micro-organisms, and the usual chemicals in factories, make it suitable for use in the manufacture of various types of goods including driving belts; while its toughness, thermal resistance, and its very roughness (by increasing its adhesion to rubber) qualify it for use in tire fabrics. It is not claimed that Ramie could or should wholly replace any of the fibers usually employed for these and other specified purposes; but it is suggested that blends of Ramie and other fibers would have special advantages conferred by the properties of the Ramie; thus when mixed with rayon, Ramie would improve resistance to moisture.

French overseas authorities are understood to be planning a rubber purchasing commission which would adopt a buying method calculated to protect rubber growers against price fluctuations on international markets. The commission would buy part of the colonial output at fixed prices, leaving the remainder to be traded freely on the open market.

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¹ Rev. gén. caoutchouc. July, 1947, p. 241; Aug., p. 281, ² Ibid., July, 1947, p. 235.

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The annual report of the Michelin concern states that output has been steadily increasing and in 1946 exceeded that of 1938. The task of restoring the Cataroux factory has finally been The task of restoring the Cataroux factory has finally been completed and production has started there. Exports of the firm's goods, though not vet back to prewar level, nevertheless reached a considerable total, and quality could be improved, thanks to the increased proportion of natural rubber it was Exports of the possible to use and the resumption of the employment of Egyptian

ITALY

Rubber Industry Improving

Reports from various sources stress the advances toward rereceivery which the Italian rubber and plastics industries here have so far been making. The local rubber industry, which in 1938 imported 28,326 tons of natural rubber, had been brought to a complete standstill by the war, but it began to revive fairly residily after the war, over it was assured of regular supplies. rapidly after the war, once it was assured of regular supplies of rubber and other essential materials, which time was not until the latter half of 1946. In 1946, Italy was able to obtain about 12,600 tons of rubber, including about 11,000 tons of natural rubber and 1,600 tons of synthetic rubber. It is expected that imports of raw rubber in the current year will amount to 30,000 tons.

According to Rubber Age and Synthetics (London)¹ about 80% of the Italian rubber industry is now engaged in the production of tires, and in spite of shortages of raw materials. coal, and electric power, outputs of these goods in 1946 came to 327,500 passenger-car tires, 229,300 truck tires, 42,000 motorcycle tires, and 5,000,000 Licycle tires, representing 48%, by weight, of 1938 amounts. In the first quarter of 1946 the output of these articles was only 12% of that of the corresponding period of 1938, but the rate of production continued to increase until in the first quarter of 1947 results working out at 79% of the level of the first quarter of 1948 could be obtained. Estimates made this past summer put possible production for the entire year at over 1,000,000 passenger-car tires and about 7,500,000 cycle tires; that is, supplies of these tires were expected to reach normal this year, but estimates for truck tires were not so favorable.

so favorable. Before the war there were 70 rubler plants altogether in Italy, employing 38,000 workers, and 90% of the output was accounted for by two firms, Pirelli and the Turin branch of Michelin. At present there are said to be 137 plants, employing 42,000 persons, of which only 60% are employed by the five principal concerns: Perelli (Milan), Bicocca (Tivoli), Michelin (Turin), Superga (Turin), Ursus (Vigavano) and F.R.I.G. (Wilan)

(Milan)

The chief exports of rubber manufacturers here have always been tires and cables: tires are produced by Pirelli, Michelin. and F.R.I.G., who also produce a variety of other rubber manufactures, and by Sigla, Zaccari, Brunello, and Valona, with

whom tires are a specialty; cables are made by Pirelli and Incet.

A group of Argentine business men is understood to be interested in the purchase of the Pirelli synthetic rubber works at Ferrara. They are said to have visited the works in Italy recently and to be prepared to begin formal negotiations.

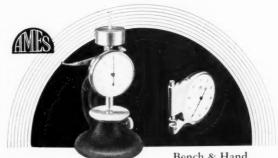
According to radio reports from Rome dated July 22, 1947, the Pirelli tire factory near Rome was destroyed by fire.

Plastics Industry Expanding

The plastics industry in Italy has been able to resume tivities in most instances. Phenol is being produced, and the activities in most instances. important phenol-formaldehyde group is operating again. A serious shortage of coke, however, is limiting the manufacture serious shortage of coke, however, is limiting the manufacture of methanol, formaldehyde, and urea in favor of calcium carbide and cyanamide, which have priority for available supplies. The leading chemical concern, Montecatini, is reported to be increasingly active and is understood to be aiming at capturing an important share of the world trade formerly held by the German chemical industry. The firm is expected to enter overseas markets shortly, especially in the Near East and South America.

It is understood that the Italian program for chemical production in 1947 aims at an output of 240,000 tons of synthetic

¹ Aug., 1947, p. 179.

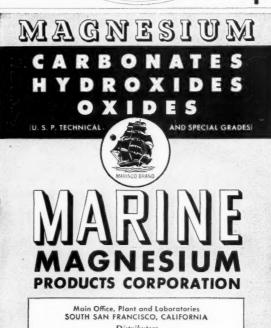


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SWEDEN

In 1946, Sweden exported 1,018 metric tons of raw and manufactured rubber, gutta percha, and balata, with a total value of 2,430,749 kroner. Included were 490 metric tons of rubber and rubber soling material, 427.6 metric tons of raw rubber and rubber somig material, 427.6 metric tons of ebonite powder, 3.7 metric tons of rubber solution. Exports of rubber manufactures in 1946 came to 96 metric tons, valued at 969.475 kroner, and included 46 tons of soles and heels, 20 tons of belting, hose, and packing, about 7.5 tons tires and accessories, and 14 tons of unspecified rubber goods, in addition 7.38 tons of wibber footbacking agelses and 28 tons of wibber footbacking agelses and agelses and agelses and agelses a to 73.8 tons of rubber footwear including galoshes and 2.8 tons of rubber-soled footwear. Norway was Sweden's best all-round customer. Czechoslovakia took most of the unworked rubber; while Finland bought all the heels and most of the soles and rubber tires and accessories. The greater part of the footware most a Switzeland accessories.

Figures for the first half of 1947 showed a considerable increase in Sweden's imports of all crude rubber and all types of rubber manufactures. Crude rubber imports were 6,242 tons, against 4,901 in the first half of 1946; imports of hose, 449 tons, against 84 tons; belting, 563 tons, against 328 tons; tires and rubler accessories for automobiles and motorcycles, 4,230 against 1,547 tons; other goods, including surgical rubber, 254 against 172 tons. No rubber footwear entered the country in the first half of 1946, but the 1947 period showed entries of 692 tons of these articles; while arrivals of rubber-soled footwear increased from six to 218 tons.

Exports of rubber manufactures dwindled to insignificance in the 1947 period with the exception of rubber footwear including galoshes and rubber soled footwear, which rose from one ton each in the first half of 1946 to 48 tons and 11 tons, respectively, in the first half of 1947.

It is reported from Stockholm, Sweden, that the Dunlop Rubber Co. and the A. B. Vanarmo Gummifabrik, a subsidiary of the Monark concern of Vorberg, have made an agreement under which the Vanarmo company is to produce bicycle tires and tubes for Dunlop for the Swedish market. The agreement, which will run for several years, obligates Dunlop to give technical assistance and to send technicians to visit the Swedish plant from time to time.

At the Thirtieth Swedish Fair held a few months ago at Gothenburg, plastics and apparatus for plastics were among the items featured. Among the apparatus for working plastics was noted a device, said to be the invention of a German refugee, for seaming plastics, which in appearance is reminiscent of older types of sewing machines and is operated by waves of electric

RUSSIA

Russia has so far received 5,988 tons of rubber from United Kingdom stocks at a price based on 1s. 3/4d. per pound, f.o.b., for standard sheet. This is in addition to direct importations from Malaya, which include a further shipment from Singapore, this time 2,000 tons, supplied by the President of the Chinese Chamber of Commerce. It seems that the two Soviet trade representatives at Singapore recently obtained permission to buy up to 10,000 tons of Malayan rubber.

For several months now an increasing number of Russian ships have been calling at Singapore to pick up rubber. During the three-month period March to May inclusive, almost 12,000 tons of Malayan rubber were shipped to Russia — 3,750 tons in March, 2,200 tons in April, and 6,000 tons in May.

According to news from Russian sources, the manufacture of plastics continues to progress favorably. Among the more recent developments is a new plastic material which is apparently an expanded, insulating, and buoyant filling product. It is said to be 20 times lighter than water and to have very low heat conductivity. It is to be used in the manufacture of refrigerators, motor boats, lifebuoys, and other articles.

The Soviet press announces that 18 new plastics plants are to be erected in the Ukraine in 1947, at Stalino, Drohobych, Uzhgorod, Poltava, Ternopol, and other cities. The first section of a factory at Dniepropetrovsk is said to have begun operations and is to produce 350 metric tons of casein plastics this year.

From another source it is learned that a new deposit of ozo-kerite, said to be the largest in the U.S.S.R., has been discovered. A large plant for processing the wax is expected to be ready for operations by the end of the year.

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GERMANY

Progress in the production of rubber goods in Germany is being hampered by various shortages; in the western section, it is chiefly the shortage of coal, power, and Buna; in the eastern section, the Schkopau factory provides plentiful supplies of Buna, but here again is a scarcity of coal, as well as of gasoline and also of some chemicals.

Almost 90% of the German rubber industry is in the Anglo-Almost 90% of the German rubber industry is in the Anglo-merican zones, where two Buna factories are located, one at Huels and one at Ludwigshafen; but the latter is not operating, and production at the former, now at the rate of 1.000 tons a month, is still far from meeting requirements. The rubber industry therefore depends largely on the Schkopau factory in the Soviet zone for Buna; in the American zone supplies of synthetic rubber are being supplemented by imports of natural rubber.

natural rubber.

The factories producing rubber goods other than tires for motor vehicles are, in the British and American zones at least, the chief sufferers from the shortages, and production of these goods here is seen to fluctuate sharply from one month to another. Even the important Continental Rubber Works of Hannover had to close down sections and reduce rate of output One of its cycle tire sections was closed for about two months in the summer.

Despite, however, difficulties which cause occasional retro-gressions, the overall picture in the rubber industry seems one of gressions, the overall picture in the rubber industry seems one of increasing activity in all zones. Regarding individual concerns, Continental now produces 50,000 tires annually for the "People's Car" Works. Recently the company also received its first major postwar order, for 50,000 cycle tires for Switzerland. In the Soviet zone, the C. A. Jahn Co., Magdeburg, has resumed the manufacture of rubber and textile driving belts. Conveyer belts for carrying coal were already being supplied by Adolph Schwartz & Co., Ketschendorf. The Elbe concern, of Klein-Wittenberg, now the only producer of rubber thread in the Russian zone, also reclaims rubber and plans building a larger plant for this branch of its activities. plant for this branch of its activities.

HOLLAND

From Holland comes news of a two-year agreement made by the Research Laboratories for Applied Science, Delft, Holland, the British Institute of Plastics Technology, and the

land, the British Institute of Plastics Lechnology, and the Flemish Engineers Association, of Belgium, to cooperate in providing courses in plastics technology.

A joint selling agency to handle sales operations in both home and export markets, has recently been formed by several important chemical firms in the Netherlands. The new undertaking, to be known as Verkoopkantoor voor Chemische Production (Sales Office for Chemical Products), expects eventually also to take over the chemical sales of other Netherlands or non-Netherlands concerns which may desire to use its facilities.



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Editor's Book Table

BOOK REVIEWS

"Buna Rubber-The Birth of an Industry." Frank A. How-

ard. D. Van Nostrand Co., Inc., 250 Fourth Avc., New York 3, N. Y Cloth, 8½ by 5½ inches, 316 pages. Price, \$3.75.

This book, by the retired president of Standard Oil Development Co. and vice president of Standard Oil Co. (N. J.), traces from its inception the development of Buna rubber in this country. The author presents an interesting and readable behind-the-scenes account of the building of the industry gained from his participation in the start and the growth of American Buna rub-

From the first beginnings of the industry, using German patents and research, through its development by means of agreements with I. G. Farben and American research, the book details the growth of the industry until the war. The enormous strides the development of the industry until the war. taken by the American synthetic rubber industry under the pressure of wartime emergency are detailed, and the narrative ends with a presentation of the industry's current status as being of vital importance to the country and the greatest new factor in world trede. world trade.

"The Technology of Adhesives." John Delmonte. Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. Cloth, 9 by 6 inches, 522 pages. Price, \$8.

This book is a commendable text covering all aspects of ad-

hesives technology. Detailed information is given on all types of adhesive materials, including animal and vegetable types, of adhesive materials, including animal and vegetable types, but particular emphasis is placed on the synthetic resin and rubber adhesives. The presentation covers the manufacturing and processing methods, properties, and methods of application of the different adhesives, together with full discussion of their uses, with emphasis on the newer applications. Many photographs, charts, and diagrams are used to illustrate the text, and the value of the presentation is further enhanced by the extensive lists of references appended to each chapter, and the comprehensive subject index to the book.

The first chapter presents an introduction and classification of

The first chapter presents an introduction and classification of adhesives. Chapters two through 13 cover individual types of adhesives, including phenolic resin, urea and melamine resin, miscellaneous thermosetting resin, polyvinyl resin, polystyrene and acrylic resin, miscellaneous thermoplastic resin, rubber, cellulose, protein, vegetable glue and natural resin, animal glues, and sodium silicate adhesives. Following a chapter on the theories of adhesive action, five chapters are devoted to specific types of adhesion, including adhesives and cements for wood, organic plastics, metal, rubber, tapes, papers, cloths, foils, and in-organic materials. The concluding chapter covers tests and spe-cifications for adhesives, together with a section on their identifi-

"Injection Molding of Plastics." Islyn Thomas. Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. Cloth, 9 by 6 inches, 542 pages. Price, \$10.

This is a detailed, specific, and thoroughly practical text on

the history, development, and mechanical problems involved in injection molding of plastics. Although the long experience of the author in the field is evident in the selection of subject matter and the precision with which it is presented, the book is written in a style simple enough for the layman to follow. Data are given on every branch of the industry and made graphic by the use of some 445 illustrations of products, ma-

chinery, and processing operations.

The book comprises eight chapters. The first two are devoted to a detailed review of the history and development of injection molding, with careful discussions of the various machines used. Following his plan of close interrelation of material and process, the author then presents an extensive discussion of the materials available for injection molding. The next chapter is devoted to molding practices, with detailed recommendations for techto molding practices, with detailed recommendations for techniques, equipment, plant layout, storage and materials handling, and safety practices. Product design and mold design and construction are covered in the next two chapters. The finishing and decorating of injection moldings are discussed in the subsequent chapter, and the final chapter presents a comprehensive survey of the factors involved in estimating and costs. In addition to an index these area an around is giving definitions of physical to an index, there are an appendix giving definitions of physical properties and another giving extensive general data on injection molded and other plastics.

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"The Standard Handbook of Textiles." A. J. Hall. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. Cloth, 8½ by 5½ inches, 296 pages. Price, \$5.

This volume is the American edition of a standard English work on the textile industry. Coverage of the subject is systematic and comprehensive. Detailed descriptions are given of the properties of the various textile fibers, both natural and synthetic, together with explanations of how these properties determine the processing methods and machinery used for each fiber. All the major processing operations are discussed, including bleaching, dyeing, printing, and finishing, and information appears on the methods and machines used for the conversion of fibers into yarn and fabrics

The steps in the manufacture, conversion, and processing of the different fibers are fully explained and illustrated by means of photographs of the machines and line drawings which show of photographs of the machines and line drawings which show the inner workings of the machines. The book is divided into six chapters or sections as follows: "The Textile Fibers"; "The Properties of Textile Fibers"; "The Conversion of Fibers into Yarus and Fabrics"; "Bleaching, Dyeing, Printing, and Finish-ing—Methods and Machinery"; "Color and Finish from the Viewpoint of Manufacturer and User"; and "The Care of Clothes and Simple Identification Tests." An adequate index is appended.

NEW PUBLICATIONS

"The Vanderbilt News." Vol. 13, No. 5. September-October, 1947. R. T. Vanderbilt Co., Inc., 230 Park Ave., New York 17, N. Y. 32 pages. The first section of this issue deals with wire insulation and discusses the use of Black-Out for protection against corona, AgeRite Stalite in natural rubber insulation, and compares the results obtained with the various Vanderbilt accelerators in GR-S insulation. Section two covers the use of the company's materials in tires and tubes and gives formulations and test results.

"Handling and Storage of Geon Latex." Service Bulletin 47-12 July 15, 1947. B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, O. 5 pages. Detailed information is given on methods and materials to be used in handling, pumping, and storing Geon latex. Means of checking stored latex to insure maintenance of stability are described, and a diagram of a suggested layout for a suitable storage system is included.

"Sharples Rubber Chemicals." Sharples Chemicals, Inc., 123 S. Broad St., Philadelphia 9, Pa. 32 pages. This is the first edition of "Sharples Rubber Chemicals." The first part deals with the company's ultra-accelerators, explaining the identifica-tion system used and giving properties and functions of the dif-ferent products. The second part of the booklet presents similar information on other Sharples rubber chemicals. A list of other synthetic organics and similar information of the products of the company of synthetic organic chemicals made by the company is also included.

"Resinex." Harwick Standard Chemical Co., Akron Savings & Loan Bldg., Akron 8, Ohio. 20 pages. Information on the properties of the Resinex series of thermoplastic resins appears, plus formulations and test data on the use of Resinex in GR-S, natural rubber, neoprene, tire tread and carcass stocks, GR-1, nitrile-type rubber, mechanical goods, in combination with GR-S as a reclaim extender, in mastic floor tile, and in non-rubber uses. A list of suggested uses is added.

"The Adhesion of Fibers to Elastomers." Report No. 47-4. May, 1947. By H. H. Abernathy and R. R. Radeliff. E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 21 pages. This report presents information on the use of aqueous adhesives, including neoprene, GR-S, rubber, and BAC latices, and non-aqueous adhesives containing MDI-50 (including natural rubber, GR-S, and neoprene cements) for bonding fibers to rubbers. The technical data given include formulations, test results, methods of amplication and uses. sults, methods of application, and uses.

"Covinylblak BA." Bulletin No. 137. Binney & Smith Co. 41 E. 42nd St., New York 17, N. Y. 2 pages. Covinylblak BA, a masterbatch of a high color carbon black in vinyl resin, is described in this bulletin, which covers the composition of the material and its handling, formulation, and advantages.



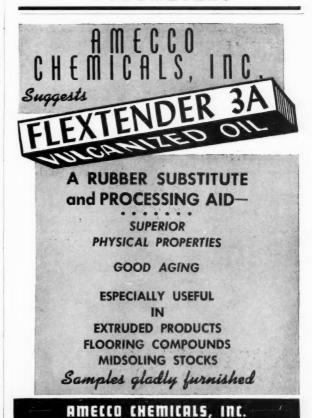
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"B-L-E-25 Antioxidant." Compounding Research Report No. 5. Naugatuck Chemical Division of United States Rubber Co., Rockefeller Center, New York 20, N. Y. 8 pages. The chemical physical, and compounding properties of B-L-E-25 are detailed, together with laboratory test data and charts comparing the results obtained with B-L-E and B-L-E-25 in a natural rubber tread stock.

"DC 710 Silicone Oils." Dow Corning Corp., Midland, Mich. 8 pages. Dealt with are the DC 710-type Silicone oils which have exceptional heat stability combined with high resistance to oxidation, freedom from gumming, water repellency, low volatility, and high flash points. Data are presented on the properties of these oils and the results obtained through their use.

"Phillips 66 Hydrocarbons. Bulletin 129A. 1947 Supplement." Phillips Petroleum Co., Bartlesville, Okla. 28 pages. This bulletin gives specifications, properties, and related information on the Phillips hydrocarbons. The application of these products to A.S.T.M. tests is also discussed, and there is a product index.

Publications of The British Rubber Producers' Research Association, Inc., 48 Tewin Rd., Welwyn Garden City, Hertfordshire, England. "The Interaction between Rubber and Liquids. VIII. A New Examination of the Thermodynamic Properties of the System Rubber Plus Benzene." Geoffrey Gee and W. J. C. Orr. Publication No. 76. 12 pages. New vapor pressure data are reported for the rubber-benzene system and used to calculate thermodynamic functions for the system. Entropy and heat of dilution of weak polymer solutions is shown to be affected by polymer-polymer molecular contacts.

polymer-polymer molecular contacts.

"A Differential Fourier Method for Refining Atomic Parameters in Crystal Structure Analysis." A. D. Booth. Publication No. 77. 6 pages. A new method for deducing molecular structure from X-ray diffraction tests is presented. The method, based on differentials of electron density at atomic maxima, requires less computation than others now in use.

structure from X-ray diffraction tests is presented. The method, based on differentials of electron density at atomic maxima, requires less computation than others now in use.

"The Accuracy of Atomic Coordinates Derived from Fourier Series in X-Ray Structure Analysis." A. D. Booth. Publication No. 78. 16 pages. A mathematical investigation of the test method is made, and sources of error are identified, together with their magnitude. Suggestions are made for possible correction of test results.

"The Structure of Polyisoprenes. VI. An Investigation of the Molecular Structure of Dibenzyl by X-Ray Analysis." G. A. Jeffrey. Publication No. 80. 16 pages. The molecular structure of dibenzyl (as a representative 1,5 diene) is redetermined using more extensive X-ray data and three-dimensional Fourier methods. The single C-C bond midway between the two double bonds is shown to be shorter in length than a normal C-C bond.

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"Tire and Rubber Industry." By Edson Gould. Smith, Barney & Co., 14 Wall St., New York, N. Y. 6 pages. This is an investment analysis of six rubber companies, including Firestone, General, Goodrich. Goodyear, Lee, and U. S. Rubber. Profits, comparative values, and company policies and problems are discussed; and stock comparisons are given as well as descriptions of the individual stock and their investment returns.

"Index to A.S.T.M. Standards." American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 242 pages. This publication, issued in June, 1947, is really an adjunct to the society's 1946 Book of Standards and enables any of the standard specifications and tests in the volumes to be found readily. All items are listed according to their subjects, and there is also a list of the standards according to the numerical sequence of their designations.

"Dunlopillo Cushioning, The Original Latex Foam Product." Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont., Canada 16 pages. This profusely illustrated booklet covers the use of Dunlopillo foamed latex sponge in bedding and various types of upholstery, including furniture and seats for vehicles, public places, etc.

"Tires and Rubber. Part I—Current Analysis." Industry Survey, Section 2, June 18, 1947. Standard & Poor's Corp., 345 Hudson St., New York 14, N. Y. 4 pages. This market survey of the larger rubber companies discusses profits and sales, charts the comparative statistical position of their stocks, and appraises the tire companies in terms of their stock earnings.

"Vulcan Green BA Extra." Circular G-473. General Dyestuff Corp., 435 Hudson St., New York 14, N. Y. 3 pages. This publication describes an organic pigment suitable for coloring rubber. Properties of the pigment are considered besides data on bleeding tests of the pigment itself and of rubber colored with the pigment. Samples of colored rubber are attached together with information on formulation of the stocks.

"The Management Leader's Manual for Operating Executives, Supervisors and Foremen." No. 1. Edited by James O. Rice and M. J. Dooher. American Management Association, 330 W. 42nd St., New York 18, N. Y. 192 pages. Price \$3. This manual is designed to promote wider understanding of managerial problems and techniques, particularly in the field of human relations. Its seven sections deal with management's leadership and human relations responsibilities, interviewing and counseling techniques, and means of diagnosing organizaton problems. Also included is a series of tests on management qualifications.

"Hewitt Restfoam Application Manual for Furniture Upholsterers." Hewitt Rubber Division, Hewitt-Robins, Inc., Buffalo 5, N. Y. 12 pages. This manual covers the use of Restfoam in furniture upholstery by means of detailed instructions and drawings of steps in the upholstery of specific items of furniture with either solid slab or cored utility stocks. A section on standard sizes of Restfoam cushions is included, giving sizes and dimensions.

"Welcome to Precision." Precision Scientific Co., 3737 W. Cortland St., Chicago 47. Ill. 8 pages. This booklet is distributed by the company to visitors of its plant. It contains a welcome from the company president. a roster of company officers and department heads, and a brief history of the company. In addition, there are a list of Chicago hotels and sights worth seeing and a map of downtown Chicago.

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Market Reviews

CRUDE RUBBER

Commodity Exchange

	WEEK-END		CLOSI			
1947	July 26	Aug.	Sept.	Sept.	Sept.	Sept 27
Sept Oct Nov Dec	15.65 15.60 15.50 15.50	15.45 15.30 15.15 15.05	15.80 15.75 15.70 15.60	16.20 16.15 16.10 16.05	16.15 16.10 16.00 15.95	17.00 16.80 16.5
1948						
Jan Feb Mar Apr May June July Aug Sept Oct Nov	15.50 15.50 15.50 15.50 15.40 15.40 15.40 15.40 15.40	15.05 15.05 15.05 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00	15.55 15.50 15.45 15.40 15.40 15.40 15.40 15.40 15.40 15.40 15.40	16,00 15,90 15,80 15,75 15,75 15,75 15,75 15,75 15,75	15,90 15,85 15,75 15,75 15,75 15,75 15,75 15,75 15,75 15,75 15,75	16.45 16.35 16.35 16.25 16.25 16.25 16.25 16.25

THE crude rubber futures market was relatively lively last month, with prices moving irregularly upward. After a start, some demand became apparent based on expectations of increased rubber con-sumption allowed in the forthcoming revision of Rubber Order R-1. With issuance of the order, another price increase took place, although traders appraised the effect of the order as being limited. No large increase in consumption was expected to occur, and it was believed that the effect of the relaxed rubber controls would not make itself felt for a few months. Fresh impetus to the rising market was given by Treasury Procurement which entered the market to buy 10,000 tons of rubber for the government stockpile. A wave of specula-tive buying made itself felt in the Ex-change during the third week of Septem-ber, based on the expectation of continued government stockpile buying. Toward the end of the month a fresh wave of specula-tive buying in combination with contract demand and the firm tone of the physical market, sent futures prices up to the 17¢ level. A contributing factor was the report additional forthcoming government stockpile purchases.

As was the case during August, primary interest in the futures market centered around the December, March, and May deliveries. The removal of inventory controls in the revised R-1 seemingly had no effect on rubber futures demand. As expected, the major rubber manufacturers are continuing their short-range buying policies, with May deliveries being as far ahead as desired.

In addition to domestic factors, the rubber market in the near future may be influenced by the general world economic position, including the Marshall Plan, and political developments in Netherlands India. Reports from there indicate that there has been considerable damage to rubber installations by native groups since the truce, and that the amount of rubber left in satisfactory condition may not be large enough to exert appreciable influence on the market when and if it is released.

New York Outside Market

THE crude rubber spot market was firm in tone during September and showed the same gradual price increase as the futures market. The strong Far East prices and the steadiness of the world's rubber markets were reflected in the New York trade where prices rose slowly during the first two weeks of September despite very moderate factory demand. Spot prices went above the 16¢ level with reports of the government stockpile purchase. During the third week of September the government purchased 7,000 tons of smoked sheet at the current market price of 16.50¢, landed. It was reported that offers of small quantities of crepe at 29.50¢ to the government toward its projected quota of 3,000 tons had been rejected.

The relaxation of controls made by the R-1 revision made itself felt toward the end of the month in the form of a broader demand. This increased demand, together with reports of further stockpile purchases by the government, sent spot prices above the 17¢ level for the first time since July 22. The spot price started the month at 15.38¢ for No. 1 ribbed smoked sheet, rose irregularly thereafter, broke through the 17¢ level to reach 17.13¢ on September 23, and closed the month at 18¢.

	11 E	EK-END	CLOSE	CLOSING PRICES				
	July 26	Aug.			Sept.			
No. 1	Ribbed	Smoke	d Sheet	s:				
Sept	15.65	15.45	15.80	16.20	16.15			
Oct	15.75	14.88	15.75	16.13	16.50	17.23		
Nov		14.88	15.75	16.13	16.38	16.88		
Dec				16.13	16.38	16.88		
No. 3								
Sheets	15.38	14.63	15.25	15.88	16.00	16.75		
No. 2								
Brown	13.50	13.63	13.25	13.00	13.25	13.50		
Flat								
Bark	12.25	11.00	11.00	11.00	11.50	11.60		

Fixed Government Prices*

Guayule Guayule (carload lots) Latex Normal (tank car lots) Centrifuged (tank car lots)	Price per Pound \$01.7½ .30¾ .32½
Plantation Grades	.00/2
No. 1X Rubber Smoked Sheets 1X Thick Pale Latex Crepe 1 Thick Pale Latex Crepe 2 Thick Pale Latex Crepe 3 Thick Pale Latex Crepe 1X Thin Pale Latex Crepe 1X Thin Pale Latex Crepe 1 Thin Pale Latex Crepe 2 Thin Pale Latex Crepe 2 Thin Pale Latex Crepe 3 Thin Pale Latex Crepe 4 Thin Pale Latex Crepe 5 Thin Pale Latex Crepe 6 Thin Pale Latex Crepe 1 Thin Pale Latex Crepe 2 Trimmings 1 Thin Pale Latex Crepe 2 Thin Pale Latex Crepe 2 Thin Pale Latex Crepe 2 Thin Pale Latex Crepe Trimmings 1 Thin Pale Latex Crepe 2 Thin Pale Latex Crepe 2 Thin Pale Latex Crepe 3 Thin Pale Latex Crepe 2 Thin Pale Latex Crepe 3 Thin Pale Latex Crepe 4 Thin Pale Latex Crepe 5 Thin Pale Latex Crepe 6 Thin Pale Latex Crepe 8 Thin Pale Latex Crepe 9 Thin Pale Latex Crepe	.23 .29 .28 .28 .28 .29 .28 .28 .28 .30 .30 .28 .28 .28 .28 .21 .28 .21 .28 .21 .28 .21 .28 .21 .28 .28 .28 .28 .28 .28 .28 .28 .28 .28
Synthetic Rubber	
GR-M (Neoprene GN) GR-S (Buna S) GR-I (Butyl)	.27½ .18½ .18½
Wild Rubber	
Upriver Coarse (crude) (Washed and dried) Islands Fine (crude) (Washed and dried) Caucho Ball (crude) (Washed and dried) Mangabiera (crude) (Washed an ddried)	.1258 .2014 .1458 .221/2 .1158 191/2 .081/2

* For a complete list of all grades of all rubbers see Rubber Reserve Co. General Sales and Distribution Circular, July 1, 1945, as amended.

SCRAP RUBBER

THOSE trade factors who expected some upturn in scrap rubber trading after Labor Day have been sadly disappointed. Business remains in a slump, and the demand for tires and tubes is still conspicuous by its absence. The larger scrap dealers report that they are absorbing very little materials in the face of a lack of outlets, while smaller dealers and collectors can neither buy nor sell any scrap.

some business is being done in No. 1 and 2 peelings, but it is spotty trading at best. Prices remained unchanged for all grades of scrap rubber during September, but are strictly nominal. Little export business is being done despite the fact that some demand exists abroad for tires and tubes. Lack of dollars and inability to secure import licenses are impeding the movement of scrap rubber overseas.

Domestic reclaimers are said to be working down their inventories of scrap and are therefore not anxious to accumulate any additional supplies at present. No one seems to know how large these inventories are, but from all indications they are sufficient to keep the reclaimers going for some time.

to keep the reclaimers going for some time. Following are dealers' buying prices for scrap rubber, in carload lots, delivered points indicated:

	Eastern Points (Net pe	0.
Minut auto diasa		
Mixed auto tires	\$10.00	\$12.00
Truck and bus tires	nom.	nom.
Beadless tires	nom.	nom.
S.A.G. passenger (natural) .		13.50
(Synthetic)	nom.	nom.
Truck (natural)	12.50	12.50
(Synthetic)	nom.	nom.
No. 1 peelings (natural)	42.50	42.50
(Synthetic)	nom.	nom.
(Recap.)	nom.	nom.
No. 2 peelings (natural)	. 27.50	27.50
(Synthetic)		nom.
(Recap.)	. nom.	nom.
No. 3 peelings (natural)	25.00	25.00
(Synthetic)	nom.	nom.
	(e pe	r Lb.)
Mixed auto tubes	nom.	3.0
Red passenger tubes	nom.	nom.
Black passenger tubes	4.0	4.0
Truck tubes	3.75	3.75
Mired puncture proof tuber	3./3	
Mixed puncture-proof tubes	nom.	nom.
Air brake hose	nom.	nom.
Rubber boots and shoes	110111.	nom.

RECLAIMED RUBBER

THE reclaimed rubber market remained relatively unchanged during September. Production continued at high levels, and demand remained satisfactory, although the reduction in demand noted in the preceding months was still noticeable. The outlook for the industry is somewhat uncertain because of conflicting factors.

John M. Ball, of Midwest Rubber Reclaiming Co., writing in the September issue of "Lockwood's Monthly Rubber Report," gives as bearish factors the relatively low price of natural rubber and the return of white and colored rubber goods. As the bullish factors, Mr. Ball mentions the increased use of 15-inch rims on passenger cars which mean greater quantities of rubber, including reclaim, per tire; the increased use of undertreads in tires with consequent higher consumption of reclaim per tire; the proposed production of so-called second-line tires having greater percentages of reclaim; and, last but not least the recognized processing advantages of reclaim in combination with other rubbers.

Final June and preliminary July figures on the reclaimed rubber industry are now some

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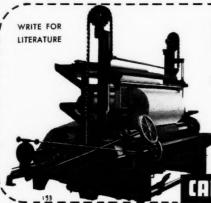
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available. Production in June was 24.144 long tons; consumption, 21,283 long tons; exports, 1,200 long tons; and stocks at the end of the month, 39,598 long tons, including long tons. Preliminary July statistics show production at 21,449 long tons; consumption, 21,025 long tons; exports, 1,052 long tons; and end-of-month stocks, 40,092 long tons; experience in the stocks of the stoc tons, including an upward inventory adjustment of 1,122 long tons.

No reclaimed rubber price changes took

place during September.

Reclaimed Rubber Prices

	Sp. Cir.	e per Lb.
Whole tire	1.18-1.20	8 / 8.5
Peel	1.18-1.20	9 / 9.5
Inner take Black	1.20-1.22	12.75/13.25
Red	1.20-1.22	13.5 /14
GR-S		9.5 /10 8.5 / 9
Butyl	1.50-1.52	8.25/ 8.75

the above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring character-istic properties of quality, workability, and gravity at special prices.

COTTON AND FABRICS

		YORK EK-END				
Fatures	July 20	Aug.	Sept.	Sept.	Sept.	Sept.
Nov 1948	34.26	31.50	31.20	31.00	31.61	30.88
Jan Mar May July Sept	33.62 33.17 32.35	31.22 31.19 30.82 30.12 28.67	30,99 30,96 30,73 30,01 28,93	31,44 31,40 31,25 30,45 29,35	31.56 31.50 31.31 30.70 29.50	30.81 30.81 30.65 30.24 29.25

THE cotton market during September was relatively quiet, with moderate fluctuation showing a downward trend for spot deliveries. The 15/16-inch middling spot price was 33.05¢ per pound on Sep-tember 2, the high for the month. The first week of trading was dull as the Exchange awaited the second government crop estimate report. After release of the report, which was in line with expectations, an increased mill demand made itself felt and the spot price recovered some of its pre-vious losses. Toward the end of the month the pressure of widespread hedging again depressed prices, and the spot quotation on September 30 was 31.10¢. Because of low mill inventories, futures prices remained quite firm during the month. The December futures price was 31.08¢ on September 2. rose irregularly to the monthly peak of 32.50¢ on September 16, and then dropped to close the month at 30.75¢.

The second government cotton crop estimate of the current season, released on September 8, indicated a total production of 11,849,000 bales, just 5,000 bales over the previous official estimate. The condition of the crop as of September I was placed at 73% of normal by the United States Department of Agriculture. The yield per acre was put at 269 pounds.

The Census Bureau announced that 710,-601 bales were consumed during August, as compared with 677,489 bales in July and 855,511 in August, 1946. Since the August, 1947, figure was so close to Exchange estimates, it had no market effect. Stocks in consuming establishments were placed at 1.154,267 bales in August, against 1.406,-077 bales in July, and 2,082,696 bales in August, 1946.

Fabrics

The cotton fabric market was stable

during September, with good demand noted for all constructions, especially for early delivery. Some price increases took place, particularly for print cloth, and brought some protests from buyers without any alatement in actual demand. Buying or wide and heavy industrial-type gray goods for fourth-quarter delivery by large users, particularly the rubber trade, moved along at a good pace during the month, with the result that many staple constructions are now tightly sold through the middle of November. Such goods as the wide sateens and sheetings are well sold up to the end of the year; while a considerable yardage of broken twills, drills, chafer fabrics, and number duck constructions is left for sale during the latter part of November and December.

Ducks are reported to be tightly sold through October, November fairly well sold, and to be in good supply for December. Steady sales were made to the rubber trade on hose and belting ducks, with no price changes noted. The coated fabric trade did not show much demand, buying largely to meet nearby requirements.

RAYON

RAYON yarn manufacturers doubted the need of filament yarn or rayon staple price increases in the fourth quarter of this year, it was reported. Although some adjustments may be made in some classifications to compensate for certain technical changes, third-quarter prices are expected to remain in effect for the balance of 1947, market observers said. The growing interest of auto tire manufacturers in rayon tire cord points out the necessity of rayon producers in keeping up with this increased demand. With new types of lowpressure passenger-car tires scheduled for mass production in 1948, producers are being pressed for the volume of heavy

denier yarns to make this production pos-

August domestic rayon shipments totaled 81,500,000 pounds, 1% above July and 12.5% above August, 1946. Cumulative eight months' deliveries of rayon this year teached 614,800,000 pounds, 10% above the corresponding 1946 period. August filament yarn shipments were 62,900,000 ment yarn shipments were 62,900,000 pounds, of which 43,900,000 pounds were viscose and cupra and 19,000,000 pounds were acetate. Staple deliveries in August were 18,600,000 pounds of which 14,000-000 pounds were viscose and 4,600,000 pounds were acetate.

Seizure by the government on August 10 of foreign holdings in the North American Rayon Corp. and the American Bemberg Corp., and the proposed sale of these holdings to American investors, are causing some concern to the rayon and rubber industries. Particular interest is directed toward North American and its production of semi-high strength viscose rayon yarns, While the leading rayon producers might ordinarily be reluctant to acquire the holdings, valued at approximately \$15,000,000, they may be forced to do so in order to prevent them from going under the control of tire manufacturers, who have often expressed interest in setting up their own rayon yarn extruding plants, but have been deterred by the tremendous investment required and the time needed for setting up such plants. The seizure of these two plants now offers the tire people an opportunity to step into the rayon field and obtain adequate facilities with which to produce at cost their own tire-type rayon yarns. If the rubber companies do express an interest in acquiring North American, then Industrial Rayon Corp., prominent in the tire yarn market, is expected to loom as key figure in bidding for the stock. While the Office of Alien Property not set a date for bidding on the plants, they are expected to be offered for sale at an early date upon completion of a government study of the two companies. their officers, and their operations.

Shipments and Consumption of Plastics and Resins

The following statistics represent the shipments and consumption, in pounds, of plastics and systetic resins for the second quarter of 1947, as reported to the Bureau of the Census, United State epartment of Commerce, by 80 manufacturing companies and company departments in April, 8 May, and 83 in June. Data on synthetic resins for protective coatings are not included.

	April	May	June
Cellulose acetate and mixed ester plastics "	7,118,772 1,329,344 331,455	6,006,235 1,052,081 ‡	5,417,555 930,815 ‡
Laminating (dry basis) Adhesives (dry basis) Molding materials * All other (dry basis) \$	3,590,468 1,952,870 15,088,906 5,652,425	4,015,364 1,944,834 16,428,733 5,021,444	3,696,974 1,587,664 17,294,181 5,187,684
	26,284,669	27,410,375	27,766,503
Urea and melamine resins: Adhesives (dry basis) Textile and paper treating (dry basis) All other, including laminating (dry basis) § ¶	4,187,095 1,482,914 615,180	3,876,904 1,556,831 668,464	4,235,157 794,438 615,012
	6,285,189	6,112,199	5,644,607
Polystyrene §	7,096,129	6,854,145	5,954,635
Vinyl resins:			1
Sheeting and film * Textile and paper coating (resin content)	5,980,883 1,424,463 6,890,397 2,020,746	4,430,884 1,431,879 5,777,376 1,485,663	2,914,699 1,083,553 4,937,022 1,610,528
	16,316,489	13,125,802	10,545,802
Miscellaneous plastics and resins * ‡ **	8,274,923	6,434,560	6,272,444
Totals	72,705,515	64,995,397	63,163,816

Includes fillers, plasticizers, and extenders,
Includes methyl and ethyl cellulose and related plastics,
Data cannot be published without disclosing operations of individual establishments.
Excludes data for protective coating resins.
Urea and melamine molding materials are included with miscellaneous molding materials.
Dry basis, including necessary coloring materials,
"Includes data for urea, melamine, acrylic acid, and miscellaneous molding materials, petroleum resins, acrylic acid ester resins, resin mixtures, and miscellaneous synthetic materials.

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United States Rubber Statistics

(All Figures in Long Tons, Dry Weight)

			June,	1947			First Six Months, 1947					
	New	Supply		Distributi	on	Stocks, End	New Supply			Distribu	Distribution	
5	Production	Imports	Total C	onsumption	Exports		Productio	n Imports	Total	Consumption	Exports	End of Month
Natural Rubber, Total Natural Latex, Total Natural Rubber and Natural		54,633* 2,422‡	54,633 2,422		311+	338,382 6,793		0 362,059 0 6,545	362,059 6,545		2.041	338,382 n,793
Latex: Total	.0	57,055	57,055	42,529	311	345,175		0 368,504	368,504	258,780	2,116	345,175
Synthetic Rubber: Total	34,5698 1,112¶	0	35,681	42,580	2,286	97,612	{ 295,16 } 8,41		393,577	313,204	9,305	97,612
GR-S	29,273\$	0	29,361	34,245	1,994	68,773	244,15 53	78 0	244,689	251,355	7,625	68,773
Butyl	3,748\$	()	3,748	4,971	()	19,024	38,04	8\$ 4	38,052	38,451	5.5	19,024
Neoprene	1,5488	()	2,045	3,043	231	5,765	{ 12,95 4,72	5§ 7°	17.682	21,072	1,315	5,765
Nitrile types	5275	()	527	321	61	4,050	3.15	45 0	3,154	2,326	310	4.050
Natural Rubber and Latex, and Synthetic Rubber: Total Reclaimed Rubber Grand Totals	35,681	57,055 57,055	92,736 24,144 116,880	85,109 21,283 106,392	2,597 1,200 3,797	442,787 39,598a 482,385	151,99	3 368,508 2 0 5 368,508	672,081 151,992 824,073	571,984 147,613 719,597	11,421 7,397 18,818	442,787 39,598 482,385

* Includes adjustment of +2,374 tons to bring imports of first half 1947 into agreement with Census reports.

* Includes adjustment of +311 tons to bring exports of first half 1947 into agreement with Census reports.

* Includes adjustment of +700 tons to bring imports of first half 1947 into agreement with Census reports.

* Government plant production.

* Private plant production.

* Includes stocks shipped for export but not cleared.

* Includes adjustment of +700 tons to bring imports of first half 1947 into agreement with Census reports.

Malayan Rubber Statistics

The following statistics for July, 1947, have been received from Singapore by way of Malaya House, 57 Trafalgar Square, London, W.C.2, England.

Ocean Shipments from Singapore and Malayan Union-In Tons

Latex, Concentrated Latex, and Revertex (Dry Rubber Content) Sheet and Crepe Malayan Union Malayan Union Direct Singapore Ship- Export Trans Singapore Export Proper shipped ments Proper shipped ments Argentine Republic 44 71 147 Australia Belgium 1.185 1,185 1,001 337 101 1,251 175 114 1,103 l'anada 15 Czechosłovakia
Denmark
Eire
Egypt
Finland
France
Germany
Greece
Hong Kong
Italy 108 80 173 245 100 70 75 Hong Kong Italy Japan Netherlands New Zealand Norway Other Countries in South America Palestine Philippine Islands and Sulu Rumania 109 32 70 28 Turkey
Union of South Africa
United Kingdom
U. S. A.
Venezuela 52 814 904 1,450 1,865 381 TOTAL 4.670 177 461 GRAND TOTAL 67.885 2.640

OTS Bibliography Reports

(Continued from page 116)

Perduren G: Composition of the Mixture and Instructions for Manufacture, I. G. Farbenin-dustrie. PB-17347. April, 1937. 23 pages. Photostat \$2; microfilm 50c. This report de-

scribes quite fully the various phases of Perduren G manufacture and use, this mate-rial being used to produce rubber goods re-sistant to swelling. The compounding ingre-dients and their influence on Perduren are noted, and the finishing process is described. Results of physical tests are also given.

Method for Production of Rubber-Like Com-

Foreign Imports of Rubber in Long Tons

Singapore Imports from	Dry Rubber		Rubber Weight
Banka and Billiton British North Borneo Brunei	12 455 97		8
Dutch Borneo	1,354		5
Other Dutch Islands Rhio Residency	29 375		
Sarawak	1,378 518		7
Sumatra	9,293		,269
Total	13,812	5	,292
Malayan Union Imports	from		
Burma	65 791 1,697		3 5 328
TOTAL	2,553		336
Dealers' Stocks			Tons
Singapore Penang & Province Welles	ley		58,779 18,182
TOTAL	******		76,961
Port Stocks in Private Lig Railway Godowns	hters an	d	Tons
Penang & Province Welles Port Dickson			5,413
Port Swettenham Singapore			1,749
Teluk Anson			472
TOTAL			20,124

positions. I. G. Farbenindustrie. PB-16384. November, 1932, 5 pages. Photostat \$1; microfilm 50c. Use of dichlorobutylene instead of 1, 3-butadiene as starting material, with subsequent separation of one mol of hydrochloric acid and formation of 1-chlorobutadiene was described in PB-16386. For the next step, one of the following methods is used: autopolymerization, heat polymerization; sodium polymerization by irradiation. This is a rough draft for a patent application. (In German.)

Examination of Japanese Aircraft Tires and Tube. V. L. Smithers Laboratories. (OSRB Report 4280). PB-22368. October, 1944. If pages. Photostat \$1; microfilm 50e. This report covers the examination of two Japanese aircraft tires and one inner tube for composition and quality of the rubber and fabric. The tires and tube are made from natural rubber and are serviceable, but show nothing noteworthy in construction, and are of only average quality. A discussion of the testing is followed by tables of physical test results obtained.

(To be continued)

RLD

ocks, and Month

15.175

9,024

4,050

12.787 39.598 2,385

Tons 8,779 8,182

6,961

Tons 5,413 41 1,749 2,449 472

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WANTED: CHEMIST WITH EXPERIENCE IN PYROXYLIN AND vinyl resin compounding and coating of fabrics. Excellent opportunity for aggressive capable man with long-established company in New England. State education and experience in detail. Salary expected. Replies in strict confidence. Address Box No. 941, care of India RUBBER WORLD.

LONG-ESTABLISHED AND HIGHLY REGARDED SUPPLIER TO the rubber industry seeks sales representative for the midwest area to replace man being transferred. Applicant should preferably be acquainted in the trade and have a background of rubber compounding and processing experience. Party chosen may live anywhere in the locality. Address Box No. 942, care of 1801A RUBBER WORLD.

CHEMIST WITH MANUFACTURING AND COMPOUNDING experience in natural and neoprene latex products. Must be able to assume responsibility for compounding, development, and research on dipped latex gloves, nursing nipples, and miscellaneous dipped goods. Give full details of expected salary, experience, age, employment record, background, and education, snapshot, if possible. Plant located in Midwest. Well established. Address Box No. 943, care of India RUBBER WORLD.

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United States Rubber Statistics

(Ml Figures in Long Tons, Dry Weight) June, 1947

First Six Months, 1947

	New Supply		Distribution		Stocks,	New Supply					Stocks,	
	Production	Imports	Total C	onsumption	Exports	ef Month				Consumption		End of Month
Natural Rubber, Total Natural Lates, Total Natural Rubber and Natural		54.633° 2,4221	54,633 2,422	41,609 920	3117	338,382 6,793		362,059 6,545	362,059 6,545	254,238 4,542	2,041	138,382 6,793
Latex Total		57,055	57,055	42,520	311	345,175	0	368,504	368,504	258,780	2,116	345,175
Synthetic Rubber: Total	1.112°	o	35,681	42.580	2,286	97,612	295,160 8,413	š 4	393,577	313,204	9,305	97,612
GR-S	29,2738 88°	6	29,361	34,245	1,994	68,773	244,157 532	0	244,689	251,355	7,625	08,773
Butyl	3,748\$	()	3,748	4,971	n	19,024	38,048	\$ 4	38,052	38,451	5.5	19,024
Neoprene	1.5488	0	2.045	3,043	231	5,765	12,955	K (1	17.682	21,072	1,315	5.765
Nitrile types	5275	()	527	321	61	4,050	3.154	e ()	3.154	2,326	310	4,050
Natural Rubber and Latex, and Synthetic Rubber: Total Reclaimed Rubber Grand Totals	35,681 24,144	57,055 57,055	92,736 24,144 116,880	85,109 21,283 106,392	2,597 1,200 3,797	442,787 39,598a 482,385	151,992	368,508 0 368,508	151,992	147,613	11,421 7,397 18,818	442,787 39,598 482,385

* Includes adjustment of +2,374 tons to bring imports of first half 1947 into agreement with Census reports.

* Includes adjustment of +311 tons to bring exports of first half 1947 into agreement with Census reports.

* Government plant production.

* Private plant production.

* Includes adjustment of -700 tons to bring imports of first half 1947 into agreement with Census reports.

* Includes adjustment of +792 tons.

Latex, Concentrated

Malayan Rubber Statistics

The following statistics for July, 1947, have been received from Singapore by way of Malaya House, 57 Trafalgar Square, London, W.C.2, England.

Ocean Shipments from Singapore and Malayan Union—In Tons

	Sh	eet and Cr	Latex, and Revertex (Dry Rubber Content)				
		Malayan Union		Malayan Uni			
То	Singapore Export Proper	Trans- shipped	Direct Ship- ments		Trans-		
Argentine Republic Australia Belgium Canada Chile China Czechoslovakia	1,185 1,001 337 101 1,251	71	533 1,103 330	17 4 	44	****	
Denmark Eire Egypt	175 114 108	15	125 402 8	2	1		
Finland France Germany	1,469 360	123	350 455 808	172	80		
Greece	10 453 679	245	223 57 1,996	75			
Japan Netherlands New Zealand Norway	900 45 242 267	100 70 109	427 25 295	····		6	
Other Countries in South America Palestine Philippine Islands and	34	****	1 32				
Sulu Rumania Sweden Switzerland	10 18	70	195 41	4		****	
Syria Turkey Union of South Africa United Kingdom	3 15 853 3,399	330 1.450	28 8.545	2 814	1 52	74	
U. S. A. Venezuela	34.379	1,865	12,837 1 28,836	2,002	177	381	
GRAND TOTAL	54,518	67,885	20,836	2,002	2.640	461	

OTS Bibliography Reports

(Continued from page 116)

Perduren G: Composition of the Mixture and Instructions for Manufacture, I. G. Farbenin-dustrie. PB-17347. April. 1937. 23 pages. Photostat \$2; microfilm 50¢. This report de-

seribes quite fully the various phases of Perduren G manufacture and use, this mate-rial being used to produce rubber goods re-sistant to swelling. The compounding ingre-dients and their influence on Perduren are noted, and the finishing process is described. Results of physical tests are also given.

Foreign Imports of Rubber in Long Tons

Singapore Imports from	Dry Rubber	Wet Rubber (Dry Weight)
Banka and Billiton British North Borneo	12 455	
Brunei	1,354	1
Java	301	
Other Dutch Islands	29	
Rhio Residency Sarawak	375 1,378	=
Siam	518	
Sumatra	9,293	5,269
TOTAL	13,812	5,292
Malayan Union Imports	from	
Burma Siam Sumatra	65 791 1.697	3 5 328
TOTAL	2,553	336
Dealers' Stocks		Tons
Singapore Penang & Province Wellesl	ey	58.779
TOTAL		76,961
Port Stocks in Private Lig	hters an	d
Railway Godowns		Tons
Penang & Province Wellesl	ey	5,413
Port Dickson	* * * * * * * * *	41
Singapore		
Teluk Anson		472
TOTAL		20,124

positions. I. G. Farbenindustrie. PB-16384. November, 1932, 5 pages, Photostat \$1; microfilm 50c. Use of dichlorobutylene instead of 1, 3-butadiene as starting material, with subsequent separation of one mol of hydrochloricacid and formation of 1-chlorobutadiene was described in PB-16385. For the next step, one of the following methods is used: autopolymerization, heat polymerization; complimerization; emulsion polymerization; or polymerization by irradiation. This is a rough draft for a patent application, (In German.)

Examination of Japanese Aircraft Tires and Examination of Japanese Aircraft Tires and Tube, V. L. Smithers Laboratories. (OSRD Report 4280), PB-22368. October, 1944, 14 pages. Photostat \$1; microfilm 59c. This report covers the examination of two Japanese aircraft tires and one inner tube for composition and quality of the rubber and fabric. The tires and tube are made from natural rubber and are serviceable, but show nothing noteworthy in construction, and are of only average quality. A discussion of the testing is followed by tables of physical test results obtained.

(To be continued)

(To be continued)

DRLD

Stocks, End of Month

345,175

97.617

5.765

4.050

442,787

482,385

ubber (eight)

69 92

36

58,779 18,182

Tons

5,413 41 1,749 12,449 472

20,124

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LONG-ESTABLISHED AND HIGHLY REGARDED SUPPLIER TO the rubber industry seeks sales representative for the midwest area to replace man being transferred. Applicant should preferably be acquainted in the trade and have a background of rubber compounding and processing experience. Party chosen may live anywhere in the locality. Address Box No. 942, care of India RUBBER WORLD.

CHEMIST WITH MANUFACTURING AND COMPOUNDING experience in natural and neoprene latex products. Must be able to assume responsibility for compounding, development, and research on dipped latex gloves, nursing nipples, and miscellaneous dipped goods. Give full details of expected salary, experience, age, employment record, background, and education, snapshot, if possible. Plant located in Midwest. Well established. Address Box No. 943, care of India RUBBER WORLD.

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Dominion of Canada Statistics

	July		July, 1946			
UNMANUFACTURED	Quantity	1.	alue	Quantity		Value
Balata	1,052 1,928,554	8	3,784	2,825	8	2,375
Latex	459,186	1.7	3,784 22,117 14,387	2,849,280 129,456		2,373 620,749 38,311
Rubber, powdered and						
waste lbs. Recoveredlbs. Synthetic and	570,000 2,177,300	17	5.629	1,452,300		24.511 139,066
Synthetic and	131,500		4,959			
substitutelbs.				200,300		42,276
TOTALS.	5,267,592	8 78	35,156	6,438,761	8	867.288
PARTLY MANUFACTURED						
Comb blanks of hard rubber	*****	S	1,462		\$	
Hard rubber in rods or tubes	1,236		1.165	3,331		4.750
Kupper inread, not	2,611		4,679			16.5
covered/bs.				2,742		4.256
TOTALS.	3,847	S	7,306	6,073	8	9,006
MANUFACTURED						
lelting loots and shoes of rubber	21111	\$ 5	9,959		8	36,134
n.o.p	4.075		9.185	9,434		7.656
Canvas shoes with rubber solesrs.	1,181		2.532			
ement	1,101	3	2.891			26,944
ement lothing of waterproofed cotton or rubber bruggists' sundries			= 10.			
ruggists' sundries		3	5,186			1,055 28,957
Druggists' sundries askets and washers doz. frs. ioffballsdoz.	1,334	3	2,103 1,965	1,409		16, 200
iolfballs	973		4,611	3.17		4,052 1,693
Teels	973 910		144	4,510		412
Hose		4	0,604	*****		20,582
nuer tubes, n.o.pno.	6,275	1	7,593 2,575	1,029		210 3,743
Bicycles	1.858		1 2 2 1	1,907		1 111
Jaquid sealing compound Mats and matting		1	3,266 9,885			6.125
Aursing imputes gross	384	-	1,415	391		6.125 38.225 1.525
Packing	885	1	5.078			13,810
Circs, pneumatic n.o.p. no.	14,140	19	3,849 5,587 2,597	8,638		183,478
Fires, pneumatic, n.o.p. no. Bicyclesno. Solid for automobiles and	14.424	1.	2.597	2,068		4.140
motor trucks no.	27		442	19		5 23
Other			5,443			3.289
fire repair material Other rubber manufactures		30	3,448			6,956 190,821
TOTAL RUBBER IMPORTS.		\$1.643	3.518	*****		598,069 1,474,363
xports of Crude and Mar						
Unmanufactured	ru.uctureu	Rubb	C1			
	3,473,922	\$ 64.	2.286	1,551,619 1,446,500	8	
Vaste rubber	1,670,400	1	,8113	1,446,500		26,702
Totals.	5,144,322	8 669	1,489	2.998.119	8	320.528
PARTLY MANUFACTURED						
Soling slabs of rubber. 168.	1.316	S	341	14,731	8	3,058
MANUFACTURED						
lathing cans		8	3.1		2	
lelting	236,502	158	31	145,085		94,977
lelts, fan			3,026			6,836
rubber n.o.p frs.	230,061	359	306	274,646		454,616
anvas shoes with rubber	121,422	0:	1,301	146,123		124,592
lothing of rubber and wa-	I I . T			140,120		
ielting	61,012	48	3,569 383	82,793		124,980 6,492
	01,012	60	.234	02,793		51,393
nner tubes for motor						
vehiclesno.	39,278 2,239	100	390	5,934		15,337 6,322
ires, pneumatic, for						
ires, pneumatic, for motor vehiclesno. Otherno.	37,653	664	.381	9.686		180.782
Other	4,645		.174	391		
insulated		225	,515 ,161			145,353
		47	.101			61,601
ther runner manufactures						.273,797

Plastics Factory for Athens

TOTAL RUBBER EXPORTS.

Hellenic Enterprises, Inc., has obtained permission of the Council of Industry of the Greek Ministry of National Economy to establish a factory at Athens for the production of plastic goods including electrical products, sheeting, and surgical instru-ments. The concern, understood to be backed by American capital, will spend about \$200,000 on the plant, which will be equipped to produce 10 to 30 tons monthly for export to the Middle East as well as for home consumption.

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36, 134

7,656

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412 20.582 210 3.743 1.441

83,478 4,140

523 3,289 6,956 60,821

4,363

3.826 6.702

0.528

4,977 6,836

4,616

4,593

4,980 5,492 1,393

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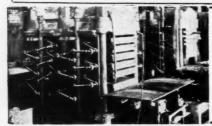
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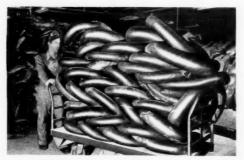


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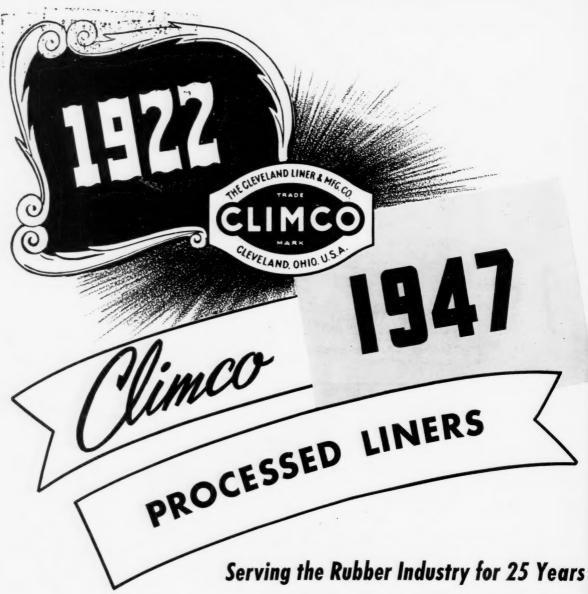


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